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X

THE

INDIAN FORESTER.

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RETIREMENT OF COLONEL PEARSON.

We translate as follows from the March Number of the "Revue des Eaux et Forêts."

"By a resolution of the Minister of Agriculture, dated the 9th of February, 1884, Colonel Pearson attached to the Forest School, Nancy, by the British Government, has been made 'Chevalier du Mérite agricole.' All foresters who know this worthy officer will approve of the honor conferred on him, earned by numerous services rendered both to forest administration in India, and to the Forest School. Colonel Pearson, who has been attached to the School since 1873, is about to retire, and will leave Nancy in the course of the year.

"He will carry with him to his own country the esteem and affection of all French foresters."

Colonel Pearson has been succeeded by Major Bailey probably till September 1886, after which date the connection between Nancy and the Indian Forest Department will be broken up, at any rate the Forest Students appointed at home, will no longer regularly attend the course at the Nancy Forest School, though they may still be deputed to France for a few months to study forestry.

Colonel Pearson, who has now permanently retired from Government service, was appointed Superintendent of Forests, Central Provinces, on the 21st September, 1860, and Conservator of Forests there on the 1st May, 1864. He was then transferred to the North-West Provinces as Conservator in September 1868, and held that appointment till 29th January, 1871, becoming officiating Inspector General of Forests till December 1872, when he proceeded home on furlough. He took charge of the English students at Nancy in 1874, and has held the appointment of Director of Forest studies at Nancy till relieved by Major Bailey last March. His kind disposition and genial manners have made him a general favorite with all Nancy men.

NOTES ON INTRODUCED TREES IN CAPE COLONY.

(*Continued from page* 111.)

At Worcester, 7 hours by rail from Cape Town, on the Cape Town and Diamond Field Railway, there is a flourishing Government plantation of Eucalypts—mostly blue-gums. The rainfall here is only 12 inches (mean of seven years 11·62 inches) per annum, but the plantation is irrigated, water being turned on seven or eight times in the course of the year. Worcester is 776 feet above the sea, and has a mean temperature of about 63° Fah. A sample-area of a third of an acre in the plantation, measured as were the sample-areas in the Nilgiri plantations, gave the following results:—

Acre-increment,... ... ... 11·77 tons.
Individual-increment, ... 0·7785 cubic feet.

The appearance of the plantation leaves little to be desired.

Besides *Eucalyptus globulus*, there has been planted recently a good deal of *Eucalyptus robusta*, which there flourishes in all the beauty of its rich foliage and sturdy stems. If anything, the growth of *Eucalyptus robusta* at Worcester surpasses that of the blue-gum. The following table shows the growth in the sample-area taken across the oldest planting which is exclusively of *Eucalyptus globulus*.

Measurement of rate of growth of Blue-gums at Worcester plantation, Cape Colony.

Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.	Number of Tree.	Girth at 5 feet	Height of Tree.	Ideal cylinder.
1	2	3	4	1	2	3	4
1	16	34	4·81	16	19	45	8·97
2	21	46	11·21	17	20	55	12·15
3	21	46	10·96	18	20	47	10·38
4	13	30	2·80	19	23	54	15·78
5	22	51	13·64	20	17	45	7·18
6	7	20	·54	21	12	32	2·54
7	21	49	11·94	22	13	39	3·64
8	15	39	4·84	23	23	59	17·24
9	18	15	8·05	24	18	54	9·66
10	22	51	13·64	25	11	34	2·27
11	15	46	5·71	26	20	56	12·37
12	9	30	1·34	27	16	42	5·94
13	21	49	11·94	28	22	59	15·78
14	19	39	7·78	29	24	61	19·41
15	26	53	19·79	30	30	65	32·32
			128·99				175·63

Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.	Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.
1	2	3	4	1	2	3	4
31	15	35	4·35	74	22	61	16·31
32	13	40	3·73	75	20	65	14·36
33	33	70	42·12	76	21	67	16·32
34	26	48	17·93	77	19	62	12·36
35	8	26	·91	78	18	60	10·74
36	24	59	18·78	79	21	70	17·05
37	28	65	28·16	80	14	50	5·41
38	23	71	20 75	81	17	44	7·02
39	17	56	8·94	82	19	42	8·37
40	22	57	15·24	83	18	45	8·05
41	19	65	12·96	84	20	60	13·26
42	19	68	13.56	85	14	36	3·89
43	25	63	21·75	86	14	45	4·87
44	12	36	2·86	87	22	60	16·04
45	11	26	1·73	88	19	57	11·37
46	25	52	17·96	89	23	70	20·46
47	28	70	30·32	90	14	46	4·98
48	16	58	8·20	91	18	59	10·56
49	22	57	15·24	92	19	56	11·17
50	12	37	2·94	93	12	40	3·18
51	19	58	11·57	94	18	61	10·92
52	18	56	10·02	95	27	65	26·18
53	16	45	6·36	96	24	60	19·09
54	13	35	3·26	97	16	39	5·51
55	8	31	1·09	98	15	43	5·34
56	9	36	1·61	99	18	46	8·23
57	12	40	3·18	100	20	58	12·82
58	20	59	13·04	101	20	57	12·59
59	12	36	2·86	102	22	63	16·85
60	14	46	4 98	103	12	40	3·18
61	23	57	16 66	104	21	58	14·13
62	22	44	11·76	105	14	50	5·41
63	30	76	37·79	106	18	60	10.74
64	19	58	11·57	107	21	68	16·57
65	15	44	5·47	108	15	50	6·21
66	23	59	17·24	109	19	64	12·76
67	22	58	15·51	110	19	50	9·97
68	19	52	10 37	111	10	34	1·87
69	18	50	8·95	112	29	60	27·88
70	23	60	17·54	113	14	36	3·89
71	10	34	1·87	114	21	52	12·67
72	19	55	10·97	115	22	60	16·04
73	12	34	2 70	116	16	50	7·07
			514·80				481·69

Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.	Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.
1	2	3	4	1	2	3	4
117	23	64	18·70	160	11	34	2·27
118	20	55	12·15	161	24	60	19·09
119	21	60	14·62	162	19	60	11·96
120	22	62	16·58	163	20	54	11·93
121	22	68	18·18	164	19	55	10·97
122	10	30	1·65	165	20	60	13·26
123	10	30	1·65	166	15	50	6·21
124	24	68	21·64	167	18	50	8·95
125	13	40	3·73	168	19	52	10·37
126	15	42	5·22	169	22	48	12·83
127	18	50	8·95	170	19	60	11·96
128	15	30	3·73	171	12	28	2·22
129	27	56	22·56	172	24	60	19·09
130	25	61	21·06	173	19	40	7·97
131	15	50	6·21	174	22	64	17·11
132	23	66	19·29	175	19	60	11·96
133	21	60	14·62	176	17	58	9·26
134	22	74	19·79	177	22	52	13·90
135	26	74	27·64	178	17	50	7·98
136	8	30	1·06	179	24	70	22·28
137	12	34	2·70	180	17	58	9·26
138	25	66	22·79	181	18	43	7·69
139	24	60	19·09	182	31	64	33·98
140	22	49	13·10	183	24	60	19·09
141	22	63	16·85	184	18	50	8·95
142	17	47	7·50	185	20	46	10·16
143	21	60	14·62	186	21	43	10·47
144	15	58	7·21	187	22	53	14·17
145	22	60	16·04	188	18	50	3·22
146	24	60	19·09	189	19	50	9·97
147	7	30	·81	190	16	42	5·94
148	13	56	5·23	191	30	68	33·82
149	21	65	15·84	192	10	30	1·65
150	8	30	1·06	193	21	50	12·18
151	16	45	6·36	194	11	31	2·07
152	21	64	15·59	195	20	60	13·26
153	24	66	21·00	196	21	54	13·16
154	9	32	1·43	197	7	24	0·64
155	27	61	24·57	198	9	34	1·52
156	9	30	1·34	199	23	42	12·27
157	19	58	11·57	200	18	42	7·52
158	14	54	5·85	201	28	60	25·99
159	18	54	9·66	202	19	38	7·58
			518·33				496·13

Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.	Number of Tree.	Girth at 5 feet.	Height of Tree.	Ideal cylinder.
1	2	3	4	1	2	3	4
203	16	45	6·36	219	9	34	1·52
204	27	60	24·17	220	19	60	11·96
205	24	68	21·64	221	24	66	21·00
206	14	40	4·33	222	25	64	22·10
207	23	65	19·00	223	27	54	21·75
208	19	62	12·36	224	18	56	10·02
209	35	74	50·09	225	9	30	1·34
210	34	55	35·13	226	25	62	21·41
211	18	57	10·20	227	11	36	2·40
212	27	58	23·36	228	9	33	1·47
213	26	70	26·15	229	18	60	10·74
214	11	30	2·00	230	21	61	14·86
215	22	65	17·38	231	22	61	16·31
216	21	50	12·18	232	23	64	18·70
217	29	74	34·39				175·58
218	24	63	20·05				
			318·79	Grand Total, cubic feet,			2809·94

Calculation of Results.—The form-factor here used (0·45) was calculated from similar blue-gum plantations in India.

Applying this figure to the above measurements of trees, we obtain—

Total stock on sample-area = 2809·94 × 0·45 = 1264·47 cubic feet, or stock per acre = 1264·47 cubic feet ÷ 0·333̇ acres (the area of the sample-area) = 3793·41 cubic feet.

The total number of trees on the sample-area is 232.

" " " per acre is 696.

Thus the actual stock on the ground per acre is 3793·41 cubic feet in 696 trees, and the cubic content of an average tree is 5·45 cubic feet.

Figures of Growth.—The yearly individual-increment is the figure representing the average growth of an average tree in a plantation, during a term of years; thus at Worcester the yearly individual-increment = 5·45 ÷ 7 (the age of the plantation) = 0·7785 cubic feet.

2. The acre-increment, a more important figure, is the average yearly yield of an average acre of fully stocked planting, over a term of years. It is the figure of growth (so many tons of dry wood per acre) which represents the actual economic value of the plantation. In calculating the acre-increment, blanks in the canopy, and thinnings, must be allowed for. Blanks in the canopy, from whatever cause produced, are, as long as they last, simply losses of productive area. Thinnings represent the realized yield, or what is sometimes called the "crop," up to date.

In the Worcester plantation the blanks are estimated at 50·25 average trees = 150·75 per acre. An average tree cubing 5·45 cubic feet, the blanks per acre are thus estimated at 150·75 × 5·45 = 821·59 cubic feet. The plantation being very young there have been no thinnings.

Thus at Worcester the acre-increment is—

$$\frac{\text{Actual stock} + \text{blanks} + \text{thinnings}}{\text{present age}} = \frac{3793{\cdot}41 + 821{\cdot}59 + 0{\cdot}0}{7} = 659{\cdot}29$$

cubic feet, or (at 56 cubic feet per ton) 11·77 tons.

The following table (p. 301) exhibits the comparison between the Worcester plantation and two blue-gum plantations of similar growth and density on the Nilgiri mountains in Southern India. Worcester has a rainfall of only 12 inches, but the plantation is irrigated, water being turned on seven or eight times in the course of the year. The Indian plantations have a rainfall of about 40 inches. Otherwise the climate is similar, the Indian plantations having a lower mean air temperature, but a hotter sun than the Worcester plantation.

The Eucalypt-like *Tristania conferta* which I tried in vain to raise in Mysore, I have noticed as a handsome free-growing tree in several localities in Cape Colony.

The Indian *Melia Azaderach* or Persian Lilac, is frequently met with planted near houses in Cape Colony, and oddly enough the colonial name for this tree is Seringa.

In some parts of the Colony poplars have been extensively planted. A species at Wynberg, apparently *Populus alba*, grows like a weed, and overruns pieces of waste ground like *Acacia dealbata* on the Nilgiris.

The common weeping willow *Salix babylonica* is frequently noticeable, planted near streams and water dams on farms. And in some of the old Dutch towns it has been planted with the prettiest effect at the edge of the watercourses which run down the side of each street. It becomes quite leafless in winter, and its sweet waving spring foliage seems to appear a week or two after that of the oak. The weeping willow is of course a type of beauty in itself, but those old Dutch tree-planters knew what they were about when they placed the oak and willow side by side, the massive glory of the one contrasting with the tender grace of the other.

I have noticed the common alder, *Almus glutinosa* growing by the side of a river, and looking exactly as it does in Europe: it is apparently the naturalized European tree, but why or when introduced, I know not. Dr. Harvey observes—"The common alder (*Almus glutinosa*) is found throughout the Colony, apparently wild, but whether truly so, or not, I cannot say." Possibly the alder may have been introduced in the old fighting days, and planted as it is in Europe, for the sake of its charcoal, which is prized in making gunpowder.

Comparative Table of Acre-increments of Blue-Gum plantations.

Plantations.	Area of plantation, in acres.	Age of sample-area, in years.	Elevation, in feet.	Area of sample-area, in acres.	Number of trees per acre now on the ground.	Form-factor used.	Actual stock now on the ground per acre, cubic feet.	Yearly individual-increment (actual), cubic feet.	Yearly acre-increment (calculated), *tons of dry wood.	Detail of Acre-increment.		
										From standing stock, tons dry wood.	From blanks in canopy, tons dry wood.	From previous thinnings, tons dry wood.
Eucalyptus globulus, or Blue-gum.												
Bathri, India. ...	60	5	7,235	1·708	847·19	0·4717	2,966	0·70021	13·067	10·593	2·474	0·00
Norwood, India. ...	26	10	7,550	1·221	416·00	0·447	6,829	1·64171	13·434	12·196	0·263	0·975
Ralia, India. ...	60	10	7,215	0·269	523·19	0·45	6,960	1·33025	12·428	12·428	...	0·00
Worcester, ...	...	7	776	0·333	696·00	0·45	3,793	0·7785	11·773	9·677	2·096	0·00

* For blue-gum, one ton of dry young wood with bark = 56 cubic feet.

There is in Cape Colony a variety of conifers which appear to be successful introductions, but have not been planted on a sufficiently large scale to test their naturalization. Of the three common European pines, *Pinus sylvestris*, *Pinus Pinaster*, and *Pinus Pinea*, the first, it has been seen, has not succeeded, while the two latter have become completely naturalized in Cape Colony. Introduced nearly 200 years ago, they are probably one of the most perfect examples of naturalization in the Southern hemisphere. *Pinus Pinaster* in Cape Colony need now hardly fear the fate which has overtaken it on the coast of Gascony, where the exceptional frost of two years ago wrought such terrible havoc on the sand-drift plantations. But *Pinus sylvestris* is so essentially a cold-loving species, extending, it is stated, to as high a latitude as 74° north, that it could hardly be expected to naturalize in a country just outside the southern tropic. A few Scotch firs are however now being tried by the Forest Department on the Eastern mountains of the Colony, at an elevation of 4,500 feet.

Pinus halepensis is of comparatively recent introduction: it appears to succeed well wherever planted. Count de Vasselot, the head of the Cape Forest Department, is in favour of the extended planting of this tree. In the Port Elizabeth botanic gardens I saw a healthy specimen of *Pinus halepensis* growing side by side with an equally promising *Pinus insignis*. In Cape Colony *Pinus halepensis* seems to be a good pine for hot dry situations, indeed it appears to grow better in the Port Elizabeth gardens and park, than the naturalized *Pinus Pinaster*. In the same gardens was the curiosity of a banyan and a Moreton bay fig growing side by side. Of these two it must be confessed that the Australian fig presented a better appearance than the Indian—of roadside memory!

Pinus insignis succeeds admirably as a garden tree, showing something of the fine growth which characterises this species on the Nilgiris; and in one locality it has been planted successfully on a large scale—at Grahamstown above the botanic gardens. While speaking of Grahamstown, let me introduce Mr. Tidmarsh and his gardens to Indian Foresters. Mr. Tidmarsh has for some years raised plants from seed sent him by the Indian Forest Department, and his gardens, the best in the Colony, would well repay a visit should any member of the Indian Forest service find his way to a corner of the world, formerly so near to, and now so far from, India. I had the pleasure of seeing quite a collection of young trees which "came from Dr. Brandis." There was deodar, raised in quantity, and with some fair specimens planted out in the gardens, but deodar seems to demand more moisture to grow well. Its right place is evidently in the Amatolas and other mountainous regions of the Colony. Generally speaking Himalayan Abies and pines show a very slow growth in the dry climate of Grahamstown,

and the same remark applies to the Californian conifers. *Taxodium distichum* and *Juniperus barbadensis*, which succeed in the damper climate of Cape Town, seem failures at Grahamstown; but on the other hand *Pinus tuberculata*, *Cupressus macrocarpa* and *Cupressus torulosa*, which showed a good growth in the wet climate of Ootacamund, seem equally at home at Grahamstown. In the Port Elizabeth gardens and park, both *Cupressus macrocarpa* and *Cupressus torulosa* grow well, but the latter seems to suffer from the wind in that exposed situation. At that place also are some trees of *Schinus mole* raised from seed brought direct from California. This singularly graceful tree has been planted for some years at Bangalore, but it was not known there from whence introduced. At Bangalore it grows freely, but does not yield fertile seed.

Quercus Suber appears to succeed on dry situations in Cape Colony, and is well worth planting on an extended scale. *Quercus Ilex*, the Holm oak so extensively planted in the grounds round Italian palaces, I have looked for in vain in Cape Colony. Its dark evergreen foliage is richly beautiful in the mellow light of an Italian winter sun; but in Cape Colony, where most of the indigenous trees are evergreen, it would not have the same *raison d'être*. Neither has one in South Africa quite the low sun necessary for the best lighting up of foliage, nor, let us add—the palaces.

The Holm oak in Italy recalls the olive. Every one has read of the olive tree culture of Italy; the olive plantations there look like natural woods. But perhaps the most curious sight is that of some of the old veteran trees, standing alone in the fields, perhaps whispering tales of the Roman Emperors, in their still vigorous leafage, their aged limbs supported on rough pillars of masonry.

There are four indigenous species of *Olea* in South Africa. *Olea verrucosa*, called the wild olive in Cape Colony, is very like the common European olive. It has a wide distribution in South Africa, extending from the Coast to some distance across the tropic on the highlands of the interior. The various varieties of the cultivated European olive can be grafted on the African wild olive, or can be raised easily from cuttings, as has been done for some years in the Cape Town botanical gardens. In fact, in Cape Colony, olive culture is a proved cultural success, exactly as in Australia, it is a success both culturally and financially. The European varieties of olive in the Cape Town botanical gardens, though in a bad situation and on poor soil, are now yielding good fruit. In Australia olive growing is fast becoming an established industry: yet in Cape Colony there are no olive plantations. The slowness of the return is probably partly the cause of this. Professor McOwan of the Cape Town botanical gardens, mentioned 17 years as about the time that must elapse before an olive planter could hope to reap any

appreciable return, and in a new country where money is scarce and people look for quick returns, this is doubtless a serious objection. But for him who can afford to wait, olive culture in Cape Colony offers no uncertain road to a competency; and how many men are there not now in India, who after 17 years in tea or coffee have achieved nothing more than a broken constitution? And in Cape Colony how many agriculturists are there not, who after struggling for years with the uncertain rainfall, have eventually abandoned the plough, poorer men than when they broke their first sod. The Cape climate is in general a hazardous one for agriculture, but on the whole is favorable to arboriculture, and tree planting would ordinarily be free from the risk from drought attending the culture of cereals.

Three species of Casuarina have been planted; two to some extent in Cape Town and the older portion of the Colony: the third species a recent and promising introduction. One of the old Cape Town species has been quite wrongly referred to as *Casuarina equisetifolia*, the well known Indian species, of which such fine plantations have been made on the Madras Coast, and on the Mysore plateau. The naturalized Cape species, which is also called "Filao," from the Mauritian name, is possibly *Casuarina muricata*. The second naturalized Cape Casuarina has been called *Casuarina tenuissima*. I have not had an opportunity of comparing either of these species with a published description. They are both poor bushy looking trees, very inferior to *Casuarina equisetifolia* in Southern India. The recently introduced species, *Casuarina leptoclada*, is as yet hardly to be met with outside botanical gardens. But it is a most promising introduction, resembling in its regular tree-like form, the tropical *Casuarina equisetifolia*; it grows fast and seeds freely. Comparing it to the common Indian species, the jointed leaf-like stems are longer and more drooping, the cone considerably larger and more globular.

Grevillea robusta, which flourishes as a planted tree in South India from 2,000 feet to 7,000 feet elevation, grows well throughout Cape Colony, but not with the same foliage and luxuriance as in India. Its manner of flowering too is different in the two countries. In India, the tree yields fertile seed, but the blossom is comparatively scanty. In Cape Colony, the tree when in blossom, presents quite a showy spectacle, the upper portion of the crown becoming a mass of golden flower, nearly equal in appearance to that of the *Poinciana regia* in flower. *Grevillea robusta* yields fertile seed, and is evidently naturalized in South Africa, but whether more at home in South Africa than in India I am unable to say, not having seen the tree in Australia. There is no doubt about the identity of the common species here and in India.

The Australian Acacias.—Acacia Melanoxylon, the Australian

blackwood, is popular, somewhat beyond its merits, in Cape Colony. From west to east it has been very extensively planted as an ornamental tree. But in the west quite a raid has been made recently on the blackwoods, on account of their liability to become infested with Dorethesia. A few months ago I visited a town lying in a scorched plain bounded by clear cut mountains, which a few years ago was described as being beautifully shaded by blackwoods. These had been all cut down by the Municipality, and gums planted in their stead. After the fashion of Dutch towns, there was water flowing down the sides of the streets, of which the trees got the benefit. Without irrigation the *Acacia Melanoxylon* in Cape Colony has a meagre starved appearance. This is very apparent to any one who can remember the fine tree of the Nilgiris, its massive umbrageous foliage flecked as with snow, when the mild weather after the south-west monsoon sets in. On the Nilgiris the planting of *Acacia Melanoxylon* on a large scale has had to be abandoned on account of the attacks of a species of Loranth, to which the tree is subject. In Cape Colony it falls a prey to the Dorethesia, and is being cut down sometimes wholesale, as in the instance given above. As on the Nilgiris it is here a free seeder but a poor coppicer.

The Australian wattles seem to grow with ease at the Cape. Plantations of *Acacia pycnantha* and *A. decurrens* have been formed near Cape Town, with every chance of large profits for tanning purposes. Perhaps *Acacia glaucophylla* is the species which has been most planted. *Acacia dealbata* grows, but not with that troublesome luxuriance which has caused as much as Rs. 30 an acre to be paid at Ootacamund for its extirpation near houses. I witnessed a few days ago a very successful case of sand drift fixing at East London by the planting of the Acacia, known as Port Jackson willow. Mr. Tidmarsh informs me that under the Colonial name of Port Jackson willow are comprised two species—*Acacia homalophylla* and *Acacia sophoræ*: both species are extensively planted as hedges and break-winds. Near Cape Point, Port Jackson willow is the only tree vegetation that can withstand the fierce tempests of the Cape of storms. It is mainly with *Acacia glaucophylla* that the Cape flats have been planted—a neck of shifting sand which joins the Cape peninsula to the mainland.

I have spoken of olives, and it remains to add a few words about fruit trees, though these have a lessened interest to Foresters, and it is time to bring these notes to a close.

The cherry and walnut, yielding both wood and fruit, must be mentioned. Both of these succeed best in the colder portions of the Colony. I have not had an opportunity of seeing either of them growing. Every effort should be made to extend the culture of the walnut, a tree so valuable both for fruit and wood. The fruit is one which can be transported to distant

markets, or made into oil on the spot. It is stated that one-third of the oil made in France is from walnuts.

The Cape fruit tree par excellence is the orange, and here there is the melancholy story of ruined proprietors, owing to the ravages of the Dorethesia. Very little remains now of the formerly magnificent orange groves in the old settled country in the west of the Colony. The Dorethesia, or Australian bug, as it is erroneously called (for it is stated to be unknown in Australia), has not spread much in the east of the Colony, but it exists at King William's Town and at Port Elizabeth. In the eastern part of the Colony there are not the large orange groves which existed in the west. Still, oranges have been extensively planted, and they are now in much the same plight as are the vines of Italy and Switzerland, with the dreaded Phylloxera on the other side of the Alps. As a tree the orange flourishes luxuriantly throughout Cape Colony, its branches bent with the burden of fruit, and the air in spring heavy with the scent of blossom ; the fruit of a size and sweetness superior to that from the hills in South India. Lemons flourish equally well. Limes perhaps better in India than in Cape Colony. I gathered some fine lemons in a garden a few days ago, the proprietor of which was positive that the trees had grown from orange pips. He sowed the pips with his own hands, and accounted for the result by the fact that the oranges were from trees grafted on lemon stocks ! A small scaly organization called "bug" prevails on orange trees here, as in America and elsewhere. This tendency to suffer from "bug" is probably exaggerated by the method of propagation adopted : fresh seed might produce hardier trees. There is an orange smaller than the ordinary fruit with a loose skin, and known by the Dutch name of Natje.

Quince hedges, peaches, and fig trees are met with everywhere, so abundant are these fruits sometimes when the rains are good, that even near large markets they are often unsaleable, and left to rot on the ground.

Apple trees require more care than in England, and the trees I have seen were bushy and stunted compared to the apple tree of Devonshire orchards. In the warmer parts of the Colony, apple trees frequently bear fruit twice during the year. Apple trees do better in the west of the Colony, where as in South Australia there is a wet Europe-like winter. I have no personal knowledge of the flavour and abundance of Colonial apples, but an improvement may perhaps be expected on the vaunted produce of Bangalore, where I have seen Madrassis pay for sour apples their approximate weight in silver.

Pomegranates and loquats grow well as would be expected.

Bananas grow fairly in Cape Colony anywhere near the coast, and where there is water sufficient to irrigate them ; but they are rarely planted, and most of the fruit on the coast markets is brought from Natal. Two kinds of bananas are met with, one

called 'banana,' and the other known by the curious Anglo-Indian appelation of 'plantain.' The names probably indicate that one kind was originally brought from India, and the other from the West Indies.

Climate of Cape Colony.—A popular description of the climate of Cape Colony would be that the winter half of the year is like a dry summer half of the year in England, and the summer half of the year in Cape Colony like an Indian winter half of the year. The mean temperature of the summer half of the year in England (April to September) is 56° Fah.; of the winter half of the year in Cape Colony 57° Fah. The mean temperature of the summer half of the year in Cape Colony is 66° Fah., which is that of a cool season in India, in places where there is a cool season.

Cape Colony lies in that region, characterized by a variable and scanty rainfall, which occurs in many parts of the world, outside the influence of tropical rains and monsoons, but where the latitude is still so low as to render a somewhat heavy rainfall necessary to agriculture and the vegetation of a fertile country. Cape Colony is essentially a dry country. The temperature when uninfluenced by elevation and the warm sea current from the Indian Ocean, termed the Agulhas current, is similar to Australia in the same latitude. At Cape Town, where the climate is probably little influenced by the Agulhas current, the mean temperature of the year is 61·7°, and the rainfall 23·31 inches. Sydney, Australia, in the same latitude, has similar figures, the mean temperature being 62·7°. Adelaide, Australia, has a mean temperature of 63·70° Fah., and a rainfall of 19·87 inches, but the high mean daily range of 20·98°. At Adelaide, Australia, as at King William's Town, and some other places in Cape Colony, the thermometer occasionally rises to 115° in the shade when a hot wind is blowing.

The mean temperature and rainfall and mean daily range for each month at Cape Town are as follows :—

Meteorology of Cape Town.

Temperature.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly mean.
Mean temperature, ..	° 68·77	° 68·99	° 66·29	° 62·95	° 58·01	° 55·85	° 54·57	° 55·21	° 57·43	° 61 06	° 64·28	° 67·61	° 61·71
Mean daily range, ..	11·13	11·76	12·28	11·26	9·17	8·66	9·07	8·89	9·41	10 36	10·34	11·46	10 32
Rainfall, ..	″ 0·880	″ 0·653	″ 0 846	″ 1·846	″ 3·576	″ 4 311	″ 2·921	″ 3·823	″ 2·332	″ 1·014	″ 1·090	″ 0·516	″ 23 309

These are established figures taken at the well known Cape Town

observatory, an institution inseparably connected with the name of Herschel, and which remains still an Imperial establishment. Only a comparative value can as yet be attached to figures from other stations in the Colony. Valuable work is now being done by a Meteorological Commission, but this has not been established a sufficient number of years to afford reliable averages. Briefly, it may be stated that commencing at Cape Town, of which the meteorology is summarized above, as soon as the Cape peninsula is doubled, the influence is felt of a warm sea current which comes from the Indian Ocean, and sweeps round the whole south-east and south coast of Africa, as far as the Cape peninsula. An antarctic current cools the dry west coast of South America ; but South Africa has unfortunately a warm gulf stream, where an antarctic current would be more in place. The difference in the temperature of the sea at Cape Town and at Simon's Town, places within a few miles of one another, but on opposite sides of the Cape peninsula, is stated on good authority, to be as much as 15°: and going eastward, while the latitude remains practically the same, there is a gradual rise in the mean temperatures, and a change in the flora towards subtropical species. The heaths, with the exception of two or three species on the eastern high lands, are confined to the western side of South Africa. The silver tree, *Leucadendron argenteum*, does not show its curious foliage outside of the Cape peninsula. It is in the west that grow those beautiful bulb flowers, *Gladiolus*, *Watsonia* and other *Iridiæ* and *Liliaceæ*, which have spread the Cape flora over the gardens of the civilized world. Going eastward, as with heaths and Proteas, comparatively few bulbs survive on the hills and mountains of Caffraria. Of the large Cape genus of *Cliffortia*, one species extends from Cape Town to Natal, but Dr. Harvey states that "the great majority of the other species scarcely extend further east than Swellendam." In the west the staple cereal is wheat, in the east maize. Again, let us take a few well know Indian and tropical genera, and notice their distribution in South Africa. There is one indigenous palm in Cape Colony, *Phœnix reclinata:* this has very much the appearance of the common *Phœnix sylvestris* of India: it occurs on the east coast, and may be said to accompany the Agulhas current as far west as George. There are two or three species of figs indigenous to South Africa, first met with in the east of Cape Colony and becoming more abundant in Natal. Probably every Indian Forester has come in contact with the genus named after the brothers Bauhin. Our Indian friend *Bauhinia* crops up again in South Africa. (I quote now from Dr. Harvey's "Genera of South African Plants," a book edited by Sir Joseph Hooker, and one which, he who dips into a new flora will congratulate himself on having found.

"*Bauhinia.*—Trees or climbing shrubs, chiefly tropical ; at least four South African species, all but one eastern."

To take another genus equally well known in India. "*Cassia.*—A vast tropical genus, much diversified; about four South African species, all eastern or from Natal."

Again, *Dalbergia.*—"Trees or climbing shrubs of warm countries. Three species in Caffraria and Natal."

Zizyphus.—"Three South African species from the northern and eastern districts."

Mimusops.—"Three or four species in Caffraria and Natal."

Croton.—"Shrubs or herbs tropical and sub-tropical. Two or three species (Cape) in the eastern district and Natal."

Eugenia.—"About eight species (some undescribed) all eastern or from Natal."

Loranthus.—"A large chiefly tropical genus: twelve (or perhaps more) Cape species, all natives either of the eastern district or of Natal."

On the coast between Grahamstown and East London, tropical fruits, such as the pine-apple, mangoes, plantains and coffee, succeed in situations sheltered from the dry cold land wind.

The origin of the Agulhas current may possibly be the back wash from the flow of water which sets in from the south to supply the fierce evaporation in the Indian Ocean. Whatever the origin of the Agulhas current, its existence and influence on the climate of South Africa are incontestable. Inland, the influence of this warm sea current is soon corrected by the increasing elevation of the country. From the southern coast the country rises, sometimes gradually, and sometimes by steps, to the high plateaux of the interior. At 50 miles from the coast the average elevation is probably about 2,000 feet. Bloemfontein the capital of the Free State, is at an elevation of 4,500 feet, and has a mean temperature the same as Cape Town, with its fresh winds from the Atlantic. The Diamond Fields, and the greater portion of the Transvaal, lie at an elevation of about 4,000 feet. Thus, from the coast to the tropic, owing to the increasing elevation, there is little difference in mean temperature. Proceeding inland, the climate of course assumes continental characteristics. It becomes brusquer, with a higher daily range, and more difference between summer and winter. Elevation in Cape Colony appears to have less influence on temperature than in England or India: this is probably due to—1*st*, the dryness of the atmosphere; 2*nd*, the high plateau character of the interior. In India the difference between the temperature of stations on the hills and on the plains is usually less during the dry season. And on plateaux, or ground rising gradually, the fall of temperature for elevation is always less than on the top of steep mountains; except in the case where the high land is covered with snow, and then the reverse often happens as in Switzerland, where cold winds sweep down from the mountains. The cause of this is sufficiently obvious in the rarification of the air and its subsequent passage over ground

heated by the sun, or cooled by snow or evaporation. In South Africa snow lies on the mountains for a few days during winter from about 3,000 feet upwards; but South African snow is too limited in area to have any appreciable effect on the climate.

Roughly, the rainfall may be stated to vary between 15 and 20 inches, according to local influences, diminishing to nothing towards the rainless deserts of the north-west. In the beautiful forest country of the southern coast, and of the eastern mountains, the rainfall is greater, as also in Natal, the garden of South Africa, where it assumes tropical characteristics. The rainfall more than the mean temperature, emphasizes the marked difference between the climate of the east and of the west of Cape Colony. The west, with its winter rains and dry summers, has a climate readily comparable with that of South Italy. In the east, dry winters are the rule, winters in which the coldness of the air is marked by the warmth of the bright sun, and in which the damp and bracing continuous cold of a European winter are absent. In considering the influence of winter and summer rain on vegetation, the different value of the same quantity of rain falling at different air temperatures, has to be taken into account. An inch of rainfall, distributed over a month with temperatures within the degrees of 40 Fah., and an English October sun, will keep the ground soaked and all vegetable tissue turgid with moisture; while 20 *inches*, under a tropical sun, will not have the same soaking effect on vegetation, supposing (what rarely happens with tropical rain) that it also is evenly distributed throughout the month. Thus in summer, in England, we look for finer weather, but not for absolutely less rain, than in winter. The spring is the slightly driest season of the year in England. Thus again, an annual rainfall of 18 inches is amply sufficient for agriculture in England; but it represents a woefully inefficient figure in South Africa, with its higher temperatures, its warm sun, and its drying winds. Thus again, the west of Cape Colony, and South Australia, with their winter rains, are more Europe-like, and better wheat and vine-growing countries, than the east of Cape Colony with its summer rains. Fortunately for the east of Cape Colony, the summer rains extend irregularly early and late; and thus much rain falls economically during the prevalence of comparatively low temperatures.

In the South African climate, the dry hot winds are a noticeable feature. All northerly winds, are necessarily winds, which become more or less dry and warm, as they descend more or less undiluted towards the coast. A cool ascending wind is more likely to progress undiluted than a warm descending wind. But unfortunately, in Cape Colony, northerly winds are more prevalent than southerly winds. The winds are quite free from the regular character of monsoons, but, speaking broadly, south-east winds prevail in summer, and north-west winds in winter. But

even in summer it is doubtful, whether away from the immediate neighbourhood of the coast, as much rain does not fall with northerly as with southerly winds. Thus most parts of Cape Colony are subject to rapid changes of temperature, changes which afford continual relief, and break the monotony of the long Cape summer, of eight or nine months' duration. There are days in midwinter, when the air temperature is as high, and the sun as hot, as in midsummer in England ; and there are occasionally cold days in midsummer, when snow falls on the mountains, and a fire would be pleasant to a dweller in the plains. On the 4th of last December the newspapers reported injury to crops from frost in the higher districts during the night ; the preceding day had been fresh and, out of the sun, cold enough to make a great coat or a fire acceptable.

A week afterwards it was reported that the crops were suffering from excessive heat. The following is a cutting from the "Kaffrarian Watchman" on the subject :—

"During the last few days the heat has been most oppressive, but upon no other day has it been so hot as it was upon Thursday last, when the thermometer stood at 171° in the sun and 112° in the shade. The following are the maximum temperatures for the last four days (in King William's Town, 1,200 feet above, and 35 miles from, the sea):—

		In sun.	In shade.
"December	9th, ...	160° ...	109°
„	10th, ...	145° ...	95°
„	11th, ...	157° ...	108°
„	12th, ...	149° ...	103°
„	13th, ...	171° ...	112°

"This return shows that we have worn out an existence during the last four days under an average maximum temperature of 156·2° in the sun and 105·2° in the shade. Yesterday as the Grahamstown post cart was coming to town, and when between Iquibica and Debe Nek, one of the horses dropped dead while in harness. The cause is attributed to the excessive heat which prevailed."

A touch of this warm wind in an undiluted form appears to have reached the coast. The following is cut from an East London Newspaper :—

"A blast of hot wind passed through East London between 9-30 and 10 A M., on Thursday last. It came right down Oxford Street and nearly stifled the town. Fortunately it did not last longer than about half-an-hour, but old Colonists say that in an experience of 40 years and more they never felt such heat. We expect to hear of scorching weather inland."

As in all dry countries, there is in Cape Colony usually a sudden fall of temperature at sunset. Except near the coast an unpleasantly warm night is nearly as rare as in England. But (as I think poor Trollope remarks) as regards the work-a-day temperature there is a great difference between England and Cape Colony. Here the temperatures lie somewhat more than half way between the invigorating cold of England and the

enervating heat of India: but the cold nights, the rapid changes of temperature, and the non-malarious character of the country, combine to render the climate one in which most English (and German) constitutions find a home, and most North European trees and vegetables, an easy naturalization. Plants and animals from South Europe, find here a climate which differs from their own only in being less continuously warm in summer, and altogether milder in winter. The Dutch colonists of pure North-European descent and characteristics have been naturalized in Cape Colony for two centuries.

In conclusion, it will be right to mention that there is a general and wide-spread opinion throughout the Colony, that the destruction of forests within the last few years has had something to do with the change for the worse, which is universally believed to have occurred in the climate of Cape Colony. Now first, with regard to a change of climate, it is necessary to be very cautious in accepting the popular verdict. It is a fact, I think, that people who suffer from any inclemency of climate, either heat, cold, wetness, or dryness, become less patient, or more sensitive to the inclemency of the climate, as they grow older, and in a question of this sort it is of course only the old people who can speak from experience. Everyone is familiar with the belief prevalent in England, that the climate has changed for the wetter; but I believe that meteorological returns furnish no foundation for this opinion. The fact is that dry cold winters, being there phenomenal, are remembered; while the ordinary mild winter leaves no impression on the memory. Who has not heard of the ox roasted on the Thames? Everyone who was alive at the time would remember such a winter as that described by Gilbert White in his Natural History of Selbourne, where a quaint remark glides in of "a close warm day, the thermometer standing as high as 50°."

In Mysore the popular belief was that the climate had changed and become drier. Whenever the rains were unusually good, old officials would wag their heads and observe that this was a return to the good old days: they could remember a time when such seasons were common. Old European inhabitants of Bangalore, and in one instance, of Madras, have assured me that their climate was certainly hotter at present than it used to be. Now, when the hottest of the large cities of the world takes to becoming hotter, it is time to cry enough with popular beliefs!

Therefore, when the old Colonist tells one that Cape Colony is drier than it used to be, I take his opinion as interesting, but forbear to speculate largely on the circumstance, till the Meteorological Commission has been some years more at work.

Facts have however been mentioned to me by well informed people both in King William's Town and East London, which go a long way to prove that there is less water in the Buffalo river now than formerly. This is a river which rises in the eastern

mountains, and falls into the sea at the port of East London. It is contended that freshets are less frequent, and do not reach so high a point now as formerly, and that the flow of water in the river is less. Several well authenticated cases have been shown me where streams which, running past a farmstead and yielding always a good supply of water, now run fitfully, or have degenerated to watercourses running after rain. It would appear, therefore, either that there is actually less rain now than formerly, or that the observations on the amount of water in the rivers and mountain streams are mistaken. But people who live on the banks of a river, who have to cross and recross it continually, whose business comes to a standstill when the river is in flood, are not likely to be mistaken as to their facts when the river sinks to a poor stream, and they can get across it at all times. Or again, if a stream running from a forest-clad valley and supplying the farms below with water gradually diminishes as the forest is cut down, and finally ceases to run, there is no question here of popular beliefs, but of plain hard matter-of-fact observation. Facts such as these in the mouths of many witnesses, cannot be gainsaid; and, while making due allowance for the water taken for irrigation within the last two decades, it is almost impossible to resist the conviction that in the eastern forest country of Cape Colony the rainfall has diminished to some extent within the last 15 or 20 years. That the water available for irrigation in the rivers and streams is less there can be no doubt.

KAD-HANDI.

GROWTH OF GRASS AND UNDERWOOD UNDER THE SHELTER OF TREES.

THE *German Botanical Society*, which was founded in September 1883, has started with great activity. A large volume of 546 pages, with numerous plates, embodies the work done during the first three months of its existence. This volume comprises, among other important papers, some contributions which may interest Foresters in India.

On page 108 *Fr. Buchenau* of Bremen, the well known author on *Tuncaceæ*, draws attention to what he considers the manuring power of the rain water which drops from the crowns of isolated trees. I will give the substance of his remarks as much as possible in his own words.

"Where, in the neighbourhood of Bremen, isolated (deciduous) trees with their crowns high above the ground, stand in meadows, on pasture land, or on the turf of parks, the grass under the crown in early spring is always far in advance of the grass in the open. As far as the branches of the trees reach, the grass is bright green, new leaves have developed,

while in the open, the grass still wears its dull brownish winter color, without any fresh leaves. In spring the grass under the trees is a week and sometimes a fortnight ahead of the grass in the open. Later in the season the difference is less marked and sometimes disappears entirely, but even in summer the grass under isolated trees is often heavier than in the open. That the grass is killed out by the shade of trees, which stand close together, or the foliage of which hangs close over the ground, is a well known fact, which requires no explanation."

So far Buchenau. On page 471 of the same volume another Botanist, E. F. von Homeyer, confirms these observations as far as the lime tree (*Tilia*), the beech and the maple are concerned, but draws attention to the fact, that other trees, such as the birch, have a decidedly injurious influence upon the growth of grass, which is exposed to the drip from their branches.

The explanation suggested by Buchenau is, that the rain water which drops from the leaves during summer contains salts in solution, which act as manure, and which stimulate the growth of grass in spring, before the leaves break out. In the case of trees with rough bark, the substances dissolved from the bark may also have a fertilizing effect, but Buchenau states that he has observed a more luxuriant growth of grass also under trees with smooth bark. He further draws attention to an observation published by Theodor Hartig in 1853, that the buds of the hornbeam in early spring exude drops of water in a manner analogous to the water drops found on the tips of leaves of grasses and other herbaceous plants. The water which is thus exuded, contains small quantities of salts in solution, and may thus have a fertilizing action.

The well known more luxuriant growth of grass and herbs on mole heaps, Buchenau mentions as an analogous fact. In the case of the mole heaps, vegetation is stimulated by the loosening of the soil, while under the crowns of trees in spring the more luxuriant growth of the grass is ascribed by him to the fertilizing effect of the drip from the foliage during the preceding summer, and to the drip from the buds during spring.

Other explanations, besides that, on which Buchenau lays stress, readily suggest themselves. The fertilizing effect of the leaves, twigs and pieces of bark which drop from the tree, and parts of which remain and decay on the ground under its branches, must be considerable, and on pasture land is added to this the manure left by cattle, which congregate under the trees. Another cause of the earlier developement of grass under trees in early spring is the protection against radiation and frost afforded by branches, even while leafless.

In India circumstances are in most cases different. As far

my recollection serves me, I have not noticed a more luxuriant growth of grass under the trees on the Calcutta *maidan*, but in the drier parts of the country grass and herbage grows more luxuriantly under, and in the vicinity of, isolated trees. Dense shade of trees growing close together, or with their crowns near the ground, kills out grass and herbs in India as well as in Europe, and if this were not the case, fire protection in India would be a hopeless task, but the shelter of partial shade promotes the growth of herbs and grass, particularly in the drier regions of India, and the chief cause of this beneficial influence is the protection which trees afford against the sun and against scorching dry winds. The provision of more abundant fodder during seasons of drought and scarcity, through the establishment of fodder reserves, on which the growth of trees is encouraged, was based upon the observations made many years ago in Rajputana and elsewhere regarding the better growth of grass under the shelter of isolated trees.

Buchenau's paper has called to my mind another remarkable fact, which merits further study by Foresters in India. Under mango trees in Oudh, the North-Western Provinces and Burma, I have often noticed a dense growth of small shrubs and herbs, such as *Clerodendron infortunatum*, *Justicia Adhatoda*, *Glycosmis pentaphylla*. This observation relates to groves and trees not cared for, and where the undergrowth has not been killed by the tread of man and cattle. A similar growth of herbs and small shrubs I have found under mowha trees in the Central Provinces, and under a variety of trees in the Madras Presidency. An analogous fact is the springing up of a dense underwood of the mulberry under sissu trees, which I first observed long ago on the islands in the Jhelum river, and which has since been noticed at Changa Manga and elsewhere, where sissu is cultivated on a large scale. The mulberry seed is doubtless brought by birds, but its spread under the trees is promoted by the shelter afforded by them, in the same manner as the growth of beech under oak or under Scotch fir in Europe is promoted by the light shade of these trees. In the same manner we found (in 1880) under the trees of the Prome teak plantation, which I had established in 1857, an underwood of evergreen trees and shrubs, such as *Strychnos potatorum*, *Ægle Marmelos* and *Ulmas integrifolia*. These instances of dense undergrowth under trees with light cover, such as teak and sissu, might be multiplied, and they are not surprising, but the luxuriant growth of herbs and shrubs under trees with dense foliage, such as the mango, is remarkable, and shows how much more powerful the sunlight is in the tropical and subtropical districts of India, than in the higher latitudes of northern Europe, where shade equally dense would kill all grass and herbs on the ground.

Analogous facts are common in India. Under the dense

shade of the evergreen forest in the Thoungyeen valley and elsewhere in Tenasserim, as well as along the Western Ghâts of the Peninsula, the ground is not bare as we find it under forests of beech and silver fir in Europe, but the space between the stems is filled up by a great variety of shrubs and large herbs, and among them are numerous seedlings of the trees which compose the forest, maintaining their existence without making much progress, until an opening in the forest, by the death of one of the parent trees, gives them a chance. Among the herbaceous undergrowth in forests with dense shade, some of the most remarkable kinds are those which belong to the large genus of *Strobilanthes*, of which the greatest variety is found on the Nilgiris and along the Western Ghâts, but some species of which are also found under the dense shade of the alpine oak (*Quercus semecarpifolia*) in the Jaunsar forests of the North-West Himalaya.

My object in making these remarks is to induce Foresters in India, who have a taste for such studies, to collect and publish more precise observations regarding the growth of grass and underwood under the shelter of trees with light and heavy cover and in the shade of dense forest, under different circumstances and in different districts and provinces.

The formation of two annual rings in one season.—The old question, whether trees, which ordinarily form one distinct annual concentric ring in the wood, may under exceptional circumstances form two such rings, has been discussed by L. Kny in the Proceedings of the Botanical Society of Brandenburg for 1879, and by K. Wilhelm on page 216 of the German Botanical Society's Proceedings, 1883, page 216, but as yet without any finally conclusive result. Kny examined young stems of the lime tree (*Tilia*), oak (*Quercus pedunculata*) and mountain ash (*Sorbus aucaparia*), which had been eaten bare by caterpillars towards the end of June, and which had re-clothed themselves with fresh foliage during the same season. The younger branches of these trees, but only the younger, not the older branches, showed two rings in the place of one, but not everywhere, and with considerable variations as regards structure and distinctness of the second ring. A specimen of the beech on the other hand, which had also been eaten bare by caterpillars, and re-clothed itself with fresh leaves during the same season, showed one ring only of normal structure.

K. Wilhelm experimented upon coppice shoots of the oak (*Quercus sessiliflora*), seven to nine years old, in the Austrian State Forest Hinterbrühl near Vienna. From four of these stems the leaves were completely cut off with scissors, two being operated upon on 7th June, 1882, and the others on 10th July. On these four stems, as well as on one stem of the same age, selected for comparison, which had been left untouched, small

pieces of the bark were removed in different places, three on each stem, the wood laid bare being protected by a thin coating of tar. The object of these marks was to determine how far the formation of the wood had progressed at the time when the leaves were removed. Late in autumn two of the stems, which had been deprived of their leaves, were felled, and together with the stem, of which the foliage had remained untouched, they were subjected to microscopic examination. The stems bared on 7th June had on 10th July clothed themselves completely with leaves, while those operated upon on 10th July had recovered their foliage on 21st August.

As regards the structure of the wood, the stem stripped in July had laid on an extremely narrow ring, only about one-third or one-fourth of the normal width, and there was no sign of a second ring. Evidently no wood had been formed after the removal of the leaves. The stem deprived of its leaves in June showed certain irregularities in the wood, which on both sides of the marks cut into the bark, and also above and below these marks had assumed the appearance of two rings. In the vicinity of the marks, both in the stem, which had been bared, as in that which had been left untouched, a large proportion of vessels were formed in the wood, the arrangement of which, in the case of the stem, which had been stripped, gave the appearance of a second ring. But a most remarkable fact is recorded by Wilhelm, which, as he observes, is in direct opposition to that recorded by Kny, viz., that the anomalous character of the wood formed by the oak, which had re-clothed itself with leaves after having been stripped, could only be seen on the older, and was not distinguishable on the younger, branches. Kny, it is true, made his observations on *Quercus pedunculata*, while Wilhelm made his experiments on *Quercus sessiliflora*, but these two species or varieties closely resemble each other in regard to the structure of the wood and otherwise.

These researches, as far as they have gone, do not yet justify any conclusions regarding the general question, whether under certain circumstances trees form more than one concentric ring of wood in one year.

In concluding his paper, Wilhelm states that he will undertake a fresh series of investigations, and promises further communications. No enquiry on this difficult subject can lead to satisfactory conclusions without microscopic examination of the wood by a competent observer, and without a large number of experiments made on trees grown under different circumstances in successive years. If there should be any among Forest officers in provinces where the teak is indigenous or is cultivated on a large scale, who are in a position to undertake such researches, it would be well worth while to make experiments with teak similar to those made with oak near Vienna. In the Himalayan forests the ash (*Fraxinus floribunda*) or the deciduous elm,

(*Ulmus Wallichiana*) with their clearly marked annual rings would be suitable trees to experiment upon.

D. BRANDIS.

AVERAGE AMOUNT OF HEARTWOOD IN SANDAL.

TO THE EDITOR, "INDIAN FORESTER."

SIR,—The following notes on a round of sandal wood sent to the Edinburgh International Forestry Exhibition from the Sigur forests of the Nilgiris may be of interest. The sketch shows the section: the heartshake shown in the sketch only went a short distance up, and after about 1 foot from the base the wood was quite sound.

The number of rings given by the section was 40, of which 26 in the heartwood and 14 in the sapwood: the bark was half inch thick.

The mean radius of the whole section was 9 inches, that of the heartwood 6 inches, the average growth being therefore about 4½ rings per inch of radius, which is fast for sandal. The ratio of heartwood, which alone is valuable to the whole amount of wood, is as $\frac{\pi r^2}{\pi R^2} = \frac{6}{9}^2 = \frac{4}{9}$, so that it may be said for this specimen that only $\frac{4}{13}$ths of the tree can be utilized, and that in making fellings the total cubic contents must be multiplied by $\frac{4}{13}$ in order to obtain the true number of cubic feet of marketable valuable wood. In rough practice one-third will probably be near enough.

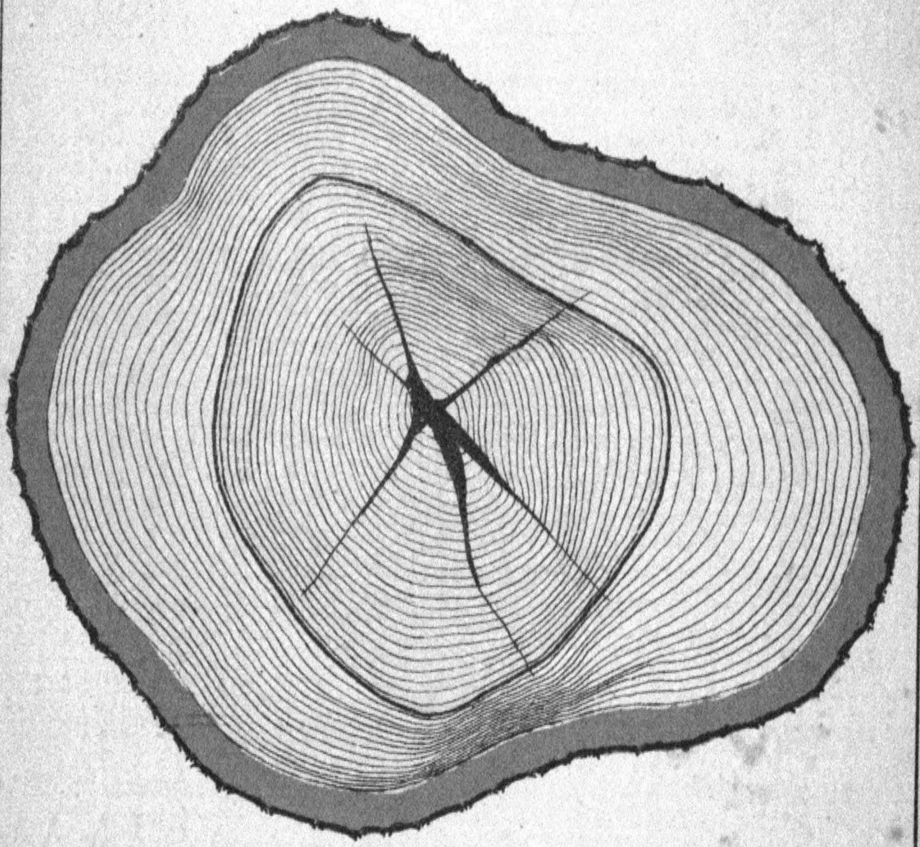
J. S. G.

RUBBER *VERSUS* TEAK.

I SEE Mr. Mann in a letter about rubber plantations in Assam states his conclusions that an acre planted with rubber would yield about four times as much as an acre planted with first class timber trees. Let us see what Colonel Beddome reports of the Nilambur teak plantations. He concludes that at 60 years old an acre will yield 6,000 cubic feet, worth Rs. 3,750, and that long before that period the cost will have been more than covered by the sale of thinnings. This is calculating at the extremely low price of 10 annas a cubic foot. The price at Calicut being nearly three times that at the present moment, and never likely to go below Rs. 1-8-0, so that in all probability the profit will be very much greater. I think myself that the thinnings will not only cover all the expenditure with interest,

Note.—We have before us a specimen of teak wood from the Andaman islands 4½ years old and with nine distinct rings.—[ED.]

AVERAGE AMOUNT OF HEARTWOOD IN SANDAL.



Heartwood 26 rings.
Sapwood 14 „
Bark $\frac{1}{8}$ inch.

Scale, $\frac{4}{10}$*ths.*

1in 2in 3in 4in 5in

Litho. T. C. Press, Roorkee. THOS. D. BONA, *Supdt.*

but will also return a fair profit: where does rubber come in now? Instead of four times better than teak it is just the other way. There is one thing to be said however that Assam seems to be a more expensive place than Malabar. But nevertheless I would lay long odds teak would hold its own even with Assam rates of labour.

By the way, is 12 feet a good average height for teak plants 18 months from the nursery? I have 50 acres which gave that average at that age. Several being over 20 feet. Do they beat that in Burmah?

HILLENAU.

SLEEPER OPERATIONS.

TO THE EDITOR, "INDIAN FORESTER."

SIR,—May I make a suggestion with regard to sleeper operations. Does it not appear a mistake that Forest officers should do the passing of sleepers? Surely that is the work of the Railway authorities. When Forest officers do the passing it leads to unnecessary expense and sometimes to slight unpleasantnesses. It is very difficult to know exactly what sleepers the Railway authorities would choose. If a Forest officer is very strict in his passing, he perhaps rejects sleepers that the Railway would have taken, and if he is the reverse, he may possibly send off sleepers which are afterwards rejected by the Railway, and the carriage of which has therefore been unnecessarily paid. Who should know better than the purchaser what he will purchase? And again, why should there be two inspections?—for the Railway authorities of course also inspect the sleepers on their arrival at the railway. Now if an officer were deputed by the Railway everything would be satisfactory.

17th May, 1884. Q.

JJ. Reviews.

PROGRESS REPORT OF FOREST ADMINISTRATION, BOMBAY, FOR 1882-83.

At the close of the year there were 9,823 square miles of reserved forests and 5,173 square miles of protected forests, or a total of 14,996 square miles. It will take a few more years to complete the demarcation. In Sind nearly 5,000 acres were lost by diluvion, and 8,000 gained by alluvion. The height of last year's inundation on the Indus was exceptional, but owing to precautions taken the loss of forest by erosion was less than that of the previous season. The Sind Conservator says that "Both in Upper and Lower Sind there is a very great demand for bhan (poplar) rafters and poles, our supply of which is limited as they are produced on newly formed katchas; it would be a very great advantage to the department if all the katchas in which the people have no proprietary rights were handed over to it as soon as they were formed."

It will be observed that more than one-third of the forests administered by the department are protected only. The Conservator of the Northern Division says that—"While the removal of dead and fallen timber and firewood, of bamboos within a reasonable limit, and of grass as extensively as possible, is very desirable in the interests of forest management, the cutting and removal of firewood and of thorns from the protected forests is to a degree objectionable; these properties both south and north of the Tápti river have been desolated for years and brought to the verge of denudation, they contain no timber; but bushes and low trees grow upon them, which if conserved would, with the valuable seedling trees which they would nurse and bring up, develop and become valuable forests: however, the present arrangements will not admit of this. A small fractional part of a protected forest may be closed for a period of years, but the remainder is left open to be overrun by cattle, including camels, sheep and goats. It is very correctly stated in Mr. Baden Powell's valuable Manual on Jurisprudence for Forest Officers that the view of all requirements of forest conservancy being satisfied by placing lands into protected forest '*is without the smallest qualification, erroneous. The provisions regarding protected forests are in no way sufficient to secure a permanent, still less an improving forest production, nor are they designed to effect such an object.*' Government have in a recent Resolution, No. 2051 of 12th March, 1883, cut down to a very great degree the privileges to be allowed to Bhíls and wild tribes and villagers in the protected forests; but these orders came out at the very close of the year, and their beneficial effect could not

be felt during the year. However, they still leave privileges inimical to forest conservancy, such as :—

"(*a*). The free grazing inside the unclosed reserved and protected forests of all village cattle of forest villages and of cattle belonging to Bhíls and wild tribes.

"(*b*). The collecting in unclosed reserved and protected forests for barter or sale, dead wood, except teak, to Bhíls and wild tribes.

"(*c*). The cutting and removal of thorns and bushwood in unclosed reserved and protected forests for barter and sale by Bhíls.

"The whole of the forests in the central tálukas of Khándesh, south of the Tápti, require to be rigidly closed against cattle grazing—especially of sheep, camels and goats—and all cutting of wood, for some years to come, if any improvement in their condition is to be hoped for, and the sooner this is done the better will the pasturage interests of the district be served."

On this the Commissioner remarks—"I cannot in any way concur in the Conservator's condemnation of the system of protected forests. The Government of India has, by finding a place for them in the Forest Act, proved that it has after due deliberation considered them necessary. Mr. Baden Powell may have strong views on the point, but he, like other Forest Officers no doubt, speaks alone from a forester's point of view. Others have to be considered, and Revenue Officers feel bound to view the matter in a broader light. As a rule where there are protected forests there it is more than probable that the cultivators have a right to demand that Government shall take care that reasonable expansion of cultivation must be provided for. Such is the case in Khándesh, and till this probability of a reasonable and just demand for extra land is satisfied the protected forests should remain classed as such."

It should, however, always be remembered that protected forest is not a permanent class or kind of forest, and that in such a forest no settlement of rights of any kind (however destructive they may be) can take place. Now it would appear that a great portion of the protected forests in Bombay are subject to serious demands for grazing and wood, and that it is of great importance to prevent their deterioration. We think, therefore, it would be advisable as soon as demarcation has been completed, or sooner if possible, to thoroughly define all rights in the more important of the protected forests, and to form them into reserved forests, giving up large areas if necessary for cultivation, as it is far better to have a small compact well managed forest than a large unwieldy tract overburdened with more or less undefined rights, thus rendering good forest management impossible. We consider that in constituting these reserves the broadest view to take of the matter would be to consider the welfare of the whole province as more important than that of the villages in their immediate neighbourhood, and eventually even these will benefit by having a good forest close by instead of a devastated scrub.

Small depôts for the supply of wood for agricultural purposes, and fuel to the inhabitants of villages in which there are no forests, have been formed in different parts of the province. We are inclined to agree with Mr. Shuttleworth that this tends to interfere with private enterprise, and if depôts are required, a few important ones only might be formed, from which merchants could purchase the various kinds of forest produce in demand, instead of Forest Officers becoming so many petty timber traders.

Free grants of wood to the value of over Rs. 16,000, or Rs. 3,000 more than in the previous year, were made, and the Conservator, Southern Division, desires that every free grant should be sanctioned by Government, specification and estimate accompanying every application, whilst the Commissioner thinks that the Collector is the best judge in the matter, and also that free grants should be made more liberally, in which the Bombay Government do not concur. Considering the trifling value of the wood in individual cases, the plan of obliging each individual raiyat to send in a specification and estimate, would we think, prove cumbersome and harassing to the applicants, but there is no doubt that the rights to timber should be defined and limited by Government, as done in other parts of India, although this may prove somewhat difficult under a raiyatwari system of land tenure.

Owing to the ravages of locusts many reserves were thrown open to grazing, and it is found that the revenue collections from conserved lands are infinitely greater than from lands in which cattle are permitted to graze constantly, and upon which ligneous vegetation is not preserved. The system of grazing permits issued to cattle owners is supplanting the lease system, which virtually gave a grazing monopoly to contractors.

We are glad to see that the plan pursued in Burma, where the Karens are induced to plant up their toungyas with teak for a small remuneration, is being tried in the kumris of Bombay, and we wish the experiment every success.

The number of prosecutions for forest offences has decreased, but surely a statement similar to that given in Statement No. VIII. of the report of the Northern Division, in which offences are classified under certain heads, is sufficient, without the elaborate details given in Statement No. VIIIA. of the Southern Division, occupying 9 pages, where every case is given separately. Example—case No. 2 setting fire to jungles, burnt an area of about $3\frac{3}{4}$ feet in length, and 3 feet in breadth, estimated loss annas 2. One offender convicted and sentenced to one day's rigorous imprisonment under Indian Forest Act VII. of 1878, Section 25. It may be proper to keep these details on record in divisional offices, but they seem quite out of place in an Annual Report.

In the Southern Division no estimate is given of the area

over-run by forest fires, whilst fire protection has been somewhat less successful in the Northern Division, and more so in Sind than in the year preceding. It is most important to have an accurate record of the progress of fire conservancy, and it is hoped that the form prescribed in the Forest Code of the Government of India will be used next year in Bombay.

Mr. Shuttleworth in speaking of natural reproduction in Sátára says—"The wonderful change which is fast spreading over the hills in the Sátára District owing to the vigorous growth of ligneous vegetation appearing upon them, and the bountiful crops of grass on all sides, has drawn from several officers, who knew the country when the hills were bare, remarks of astonishment and approval—astonishment that Nature, when given fair play, is able so quickly to assert her power; approval because the transformation of a brown and parched surface radiating heat into a carpet of verdure is pleasing to the eye, and conveys to the senses the impression of comfort and plenty. The truth of Horace's proverb *naturam expellas furcâ tamenusque recurrit*, finds ample exemplification upon the mountain ranges and hill slopes of this district. The Forest Settlement Officer, Sátára, in one of his reports remarks:—

"'The spur below Sátára is a fine specimen of hill-side, re-clothed by careful conservation. It bears quite a different appearance now, to what it did only six years ago.'"

Para. 29 of the Sind report is also interesting, and runs as follows:—"This was an exceptional year as regards rainfall and the rise of the river. The latter was higher than it has been known to be for years, in consequence of which a very large proportion of the high-lying tracts that are above the ordinary inundations were flooded. Advantage was taken of this, and all such tracts were enclosed and are now fairly stocked with naturally-produced plants. It is very remarkable how long seed lying apparently on the surface of high sun-baked land retains its vitality. One season's exposure to the sun, night dews, and occasional showers of rain would be sufficient, one would imagine, to destroy it. This is not the case for seed that must have lain for years under the conditions mentioned above, germinated after the late high floods."

Over Rs. 14,000 were spent on plantations, and we recommend the system of utilising the Forest Guards in broad-cast sowing and in pitting over large areas to the attention of Conservators in other provinces. Extensive regular plantations were also formed, but unless some such statement as that prescribed by the Government of India in their Forest Code be adopted, it is most difficult to arrive at a correct idea of the progress of planting operations, in fact it is impossible to discover from the present report either the total area under regular plantations or the area sown up by Forest Guards.

The *Prosopis glandulosa* introduced from Texas have thriven remarkably well in Sind.

There is a striking difference in the amount spent on communications in the three Conservatorships, thus—

	Rs.
Northern Division, ...	646
Southern „	21,310
Sind „	96

and His Excellency the Governor in Council considers that more money might be expended with advantage in the Northern Division and Sind.

The financial results were most satisfactory, the net revenue amounting to over 8 lakhs, or 1½ lakhs more than that of the previous year. In Bombay, timber produces the greater part of the revenue, whereas in Sind, it is firewood. The Sind forests are well stocked with babul (*Acacia Arabica*), but unfortunately kandi (*Prosopis spicigera*) is now more in favor as fuel, and the Sind Conservator says that—

"According to the latest indents received, the consumption by the railway has risen to 125 lakhs of cubic feet, or 25 lakhs of maunds a year. This quantity represents a good crop of kandi of 20 years' growth on 29,000 acres; therefore allowing a 20 years' rotation, we require 580,000 acres to keep up the supply at the above rate. Nearly the whole of this land will have to be newly taken up, as our old reserves cannot contribute much to the supply, because they are either too far from the line to be worked profitably, or are only capable of yielding babul, which wood has been condemned. The area of the tracts awaiting forest settlement is 373,544 acres."

In Appendix C to the Sind report, we observe that a cubic foot of firewood is supposed to weigh rather over 45 lbs., but as the wood in question is chiefly babul and kandi, which weigh over 55 lbs. per cubic foot, the estimate appears to be too low.

In the report of the Northern Division, it is stated that one-fourth weight of the firewood brought into the Mahabaleshvar depôt is lost by dryage and wasteage; to avoid this the best plan would be to work and sell by the cubic foot.

The crop of Myrobolans was much injured by locusts which devoured the flowers.

The bark of the Ain (*Terminalia tomentosa*) was stripped off the trees felled for the market, the fishermen on the coast using it for tanning their nets.

A favorable report was made of the work of the District Forest Officers, without a single exception, and the thanks of Government were accorded to the three Conservators.

KHERI FORESTS, OUDH.

These forests, situated between the Sarda and the Nepalese frontier, contain the finest sál timber in Oudh. They have an area of 265 square miles, stocked as follows:—Sál, 146 square miles; mixed forest, 37 square miles; sissu and khair, 23 square miles; grass lands, 59 square miles.

The following list will give a general idea of the forest flora :—

Sál Forest.

Dillenia pentagyna.
Kydia calycina.
Grewia species.
Murraya Kœnigii.
Clausena pentaphylla.
Ochna pumila.
Garuga pinnata.
Lœa aspera.
Schleichera trijuga.
Semecarpus Anacardium.
Buchanania latifolia.
Indigofera species.
Millettia auriculata.
Pterocarpus Marsupium.
Dalbergia volubilis.
Bauhinia species.
Spatholobus Roxburghii.
Terminalia bellerica.
„ Chebula.
„ tomentosa.
Eugenia operculata.
Careya arborea.
Lagerstrœmia parviflora.
Cascaria graveolens.
„ tomentosa.
Adina cordifolia.
Stephegyne parvifolia.
Bassia latifolia.
Holarrhena antidysenterica.
Calosanthes indica.
Stereospermum suaveolens.
Clerodendron infortunatum.
„ siphonanthus.
Ficus bengalensis.
„ Wightiana ?
„ religiosa.
„ cordifolia.
Euphorbia acaulis.
Briedelia retusa.
Phyllanthus Emblica.
Tiliacora racemosa.
Crataeva religiosa.
Amoora Rohituka.
Elæodendron Roxburghii.
Eugenia Jambolana.
Tetranthera laurifolia.
Ficus Cunia.
„ glomerata.
Antidesma diandrum.
Salix tetrasperma.

Along nullahs and in moist places generally.

Mixed Forests.

Miliusa velutina.
Saccopetalum tomentosum.
Sterculia villosa.
Glycosmis pentaphylla.
Ægle Marmelos.
Ougeinia dalbergioides.
Cassia Fistula.
Albizzia procera.
Eugenia Jambolana.
Woodfordea floribunda.
Hymenodictyon excelsum.
Gardenia turgida.
Randia dumetorum.
Diospyros Melanoxylon.
Wrightia tomentosa.
Ehretia lœvis.
„ serrata.
Loranthus longiflora.
Mallotus phillipinensis.
Briedelia stipularis.
Putranjiva Roxburghii.

Sissu and Khair Forests.

Tamarix dioica.
Bombax malabaricum.
Zizyphus spec.
Cæsalpinia Bonducella.
Alangium Lamarckii.
Vallaris dichotoma.
Calatropis gigantea.
Streblus asper.
Ficus infectoria.
„ trachycarpa.
„ hispida.
Trewia nudiflora.
Piper longum.

Grass Savannahs and borders of *Tals*, &c.

Helicteres Isora.
Grewia sapida.
Zizyphus species.
Odina Wodier.
Erythrina resupinata.
Butea frondosa.
Crotalaria species.
Barringtonia acutangula.
Careya herbacea.
Randia uliginosa.
Gmelina arborea.
Phœnix acaulis.

The sál forests are found on belts of high ground formed by the action of the great rivers issuing from the Nepal Himalayas. The soil consists chiefly of sand brought down by the Sarda in ages long gone by from the crystalline rocks of the inner hills, the high bank or dammar being formed by a deposit of clay or stiff loam, which owing to its state of minute division was held in suspension longer than the coarser particles, and in consequence carried farther down the stream. Sál is the predominant species on the elevated sandy ground, its only rival in size being Asaina (*Terminalia tomentosa*), which however does not as a rule form a large proportion of the 'peuplement,' and owing to its light foliage there is no danger of its driving out the more valuable species, in fact sál seedlings are common under large Asaina.

Dillenia pentagyna is here a small tree, not attaining the size it acquires in Burma, and is not found west of Oudh. *Clausena pentaphylla*, a small shrub of the orange family, is easily recognised by its highly aromatic leaves. Only two trees of *Pterocarpus Marsupium* were found, but Brandis says it has not been reported from these forests. *Lagerstræmia parviflora* is most abundant in the more open parts of the forest, and seems more capable of withstanding fires than its neighbours. The large climber *Dalbergia volubilis* is common in parts, and the undergrowth often consists chiefly of *Casearia graveolens* with its disagreeable smelling leaves. Many seedlings of *Adina cordifolia* were observed growing in hollow sál stumps, humorously termed flower-pots by the Divisional officer. *Tiliacora racemosa* found from Oudh eastwards, is a large evergreen climber, enveloping the tallest trees in its dark green foliage, and is plentiful near watercourses. *Bassia latifolia* is abundant in the Khairigarh sub-division, and small trees of *Amoora Rohituka* were not unfrequent near water-courses and in damp ravines, although Brandis says it occurs in Oudh, only in the Gonda forests.

The mixed forest occupies the clay bank or dammar bordering sál forest, and also stiff binding soil in the sál forest itself. It contains no timber of great value. The wood however of *Putranjiva Roxburghii* found here and there in low shady moist places is even-grained and durable. *Glycosmis pentaphylla*, a small evergreen shrub of the orange family, forming occasionally thick undergrowth, is not found west of Oudh. *Diospyros Melanoxylon* is common, but gives only a small amount of ebony. It thrives better in Bahraich. *Briedelia stipularis* is a large more or less climbing shrub abundant in places.

The sissu and khair forests along the banks of all the larger rivers are accompanied by the usual inferior species. A small revenue is derived from *Piper longum* (long pepper), by leasing the right of collecting the fruit. This pepper climbs about the *Zizyphus* bushes, &c.

The grass savannahs, or phantas as they are called, usually have a *tal* or *jhíl* as their nucleus, from which they have invaded the forest, but signs are apparent of the tables in many instances being turned, and of the sál area increasing at the expense of the phanta, which is often bordered by a dense growth of sál saplings getting shade without cover from the older trees. Perhaps the early burning of the phantas may have something to do with this phenomenon, as they are burnt whilst the grass along the border of the forest, shaded as it is by high trees, is still green, so that this border may frequently escape burning altogether. The flora of these phantas has evidently adapted itself to the condition of life brought about by the occurrence of fierce annual grass fires, and to the constant struggle which has to be maintained against them. Thus we find a dwarf *Erythrina* (*E. resupinata*), which immediately after the fires sends up short racemes of large bright scarlet flowers from a perennial underground stem, a dwarf *Careya* (*C. herbacea*) sometimes mistaken for a stunted form of *C. arborea* (kumbi), a dwarf *Grewia* (*G. sapida*) with a short, thick, woody underground stem throwing up a number of herbaceous shoots about a foot high, which are burnt down in the hot season, and the dwarf date palm *Phœnix acaulis*. *Helicteres Isora*, called bhendu locally, which almost becomes a small tree in parts of the North-West, has here degenerated into a small shrub with a woody stock, sending up annually a number of slender twigs used in thatching, and which are regularly burnt to the ground by the grass fires.

Immediately after a fire has passed through the sál forest, numerous little green flowers of *Euphorbia acaulis* may be observed in bunches of three to seven springing from the crown of the (now leafless) tuber, which is rather larger than a carrot, and full of acrid milky juice. Is it not possible that these dwarfish plants, with their enlarged underground stems, may have been gradually evolved by the action of fires from larger species of the same genera, and have acquired in time certain distinct characters, which have caused them to be classed as distinct species? Perhaps *Helicteres Isora* is now undergoing a similar change, and will in time be separated from the larger variety. There are no indigenous bamboos, but the few planted promise to do well.

From valuation surveys made in 1879, over 0·7 per cent. of the estimated area under sál, it appears that there are per acre :—

1st class, sál 6 feet in girth and above,	...	3·64
2nd „ „ 4 feet 6 inches to 6 feet, ...	...	5·29
3rd „ „ 3 feet to 4 feet 6 inches, ...	...	10·52
4th „ „ 1 foot 6 inches to 3 feet, ...	...	31·06
		50·51
Other kinds, ...	...	57·08
Total,	...	107·59

And Mr. Brandis says with reason that the forests are not very densely stocked, an average of 107 trees of all classes per acre to saplings of 18 inches in girth, of which only 12 trees are 4 feet 6 inches and upwards in girth, does not cover the ground. A better stocked forest with double the number of trees would contain less grass, and would be more easily protected from fire. Captain Wood estimates that two-thirds of the 1st class trees are unsound, but considers that many of these bad trees can be utilised for sleepers, &c.

This was attempted last season, but great difficulty was experienced in marking only the worst trees, as fellings took place both in forests where the 1st class trees had already been cut out, and in forests which had not been touched up to date. It will probably in future be advisable, in order to prevent sound 1st and 2nd class trees being converted into sleepers, to confine these operations to the parts where selection fellings of 1st class trees have been made lately.

Great differences of opinion exist concerning the number of trees to be felled annually, and the question has been under discussion for years, but it is evident that owing to the small percentage of the area valued, and to the uncertainty concerning the number of unsound trees, nothing can be prescribed with any degree of accuracy until more extensive valuation surveys are made. Considering the importance of the forest, the facility of export, and the fact that even the bad and crooked trees can be utilised, it seems plain that a valuation survey of the whole area under sál should be undertaken. A rough preliminary working plan might then be drawn up from the data obtained. Sound and unsound 1st class trees are not evenly distributed over the forest, and a valuation survey accompanied by good maps and a descriptive account would be most useful in indicating the condition of the different blocks about which little is known at present; thus in some blocks the grass is high and abundant, whilst the trees are scattered and crooked, the proportion of sound 1st class trees being almost nil. In such blocks, especially those not protected from fires and with a small number of seedlings, it appears to be very injudicious to cut out most of the crooked trees on the ground that they are deteriorating. In going through a block of this kind, it was observed that the 4th class of trees, viz., those from 1 foot 6 inches to 3 feet in girth, was almost entirely absent, the other classes being mostly unsound, crooked and sparse, whilst the grass was very high, so that it seemed as if a struggle had been going on between the grass and the trees, in which the former had got the upper hand, in fact some young sál might be seen having the appearance of standard roses (not in flower *bien entendu*), with a stoutish stem reaching to the top of the grass, from the summit of which a number of young shoots were yearly sent out destined to be yearly burnt down. Can

the future of such a forest unprotected from fire be improved by cutting out all the crooked trees (there are scarcely any others), and will not the grass obtain the complete mastery and convert a forest into a phanta? The correct treatment of such a block would seem to be its protection from fire and the restriction of cuttings, so that the growth of sál, other trees and bushes, by increasing the cover overhead, may keep down the grass, and in a short period take exclusive possession of the soil, as is happening in some parts of the forest near Dudna, which has been successfully protected since 1875.

Captain Wood in his report for 1881-82 remarks that—"We want the trees to have long clear stems free from knots for building purposes, long beams, rafters and planks; and the longer and straighter the stem the more valuable the timber, and nature plants these trees thickly, and provides them with suitable leaves that can bear shade." In order to obtain this most desirable state of affairs, it will be wise not to depart from the principles laid down by Mr. Brandis in his suggestions of 1881, which are here quoted.

"The instances of young sál forests which have come up where large trees have been cut down, show that the growth of young sál is promoted by abundance of light, but the risk through the increase of grass is too great to render complete clearances advisable. A safer plan certainly is to kill out the grass as much as possible by increasing the cover overhead and by fire protection.

"As soon as any blocks or compartments are completely filled with young growth, all trees which are marketable should be cut, and other trees which cannot be sold should be killed by girdling. When this is done it will be seen that poles of sál and other trees will shoot up with extreme rapidity, while at the same time the absence of grass will render fire-protection easy."

The sál logs brought from Nepal are much rounder and straighter than those obtained from Kheri, and the further from the hills the worse the timber, the cause of which is attributed in part to the hot winds of the dry season.

Owing to the luxuriant grass, fire-protection is very difficult, and the isolation of the different blocks has not yet been secured, as the interior fire lines, which follow the excellent cart roads, are only 75 feet wide, and are inadequate to check the spread of a fire from one block to the next.

The phantas within or bordering on the protected area are burnt early in the season, and in many cases they would make most useful interior fire lines, as it happens that many of them are separated from each other by only narrow strips of forest, through which broad fire lines might be made. They would form an excellent barrier to the fiercest fire both from their breadth and from the fact that being practically destitute of

trees, dry leaves do not accumulate on them, as is the case along the roads, but the present lines should also of course be maintained in every case.

In some parts of the open forest where the soil and drainage is good, a healthy young lot of sál saplings cover the ground, growing up thickly together. These were no doubt burnt down year after year, until increasing in number and strength they succeeded in driving out the grass; in other parts, however, reproduction is not satisfactory, and has evidently been much checked.

War to the knife has been waged against all creepers, and the *Bauhinia vahlii* has been almost exterminated.

In the sissu and khair forests a considerable quantity of Cutch is manufactured. In 1882-83 the dues amounted to Rs. 18,599, at 9 annas a pot; this equals 33,045 earthen pots, capable of containing about 3 gallons of water each. No estimate appears to have been made of the number of trees used. In Pegu in the same year Rs. 70,000 were received from Cutch licenses, and it is estimated that 168,000 trees were boiled. The rate levied was Rs. 20 per cauldron of 12 gallons, so that there is a very great difference in the rates charged in the two provinces.

The roads, buildings and wells are most excellent, indeed without them the extensive sleeper operations (over three lakhs of sleepers were sawn) which were undertaken last season could never have been accomplished. The only fault about the roads is that their mathematical straightness, combined with the uniformity of the forest, would make them painfully monotonous, were it not for the occasional breaks caused by the phantas, *tals* and *jhils*.

Here the sportsman is in his paradise; game of all kinds abounding, from the lordly tiger to the timid hare, and from the gorgeous peacock to the homely jack snipe. Some good bags were made last season, but the number of cartridges wasted by certain would-be sportsmen had better not be mentioned.

III. Timber Market.

CHURCHILL AND SIM'S WOOD CIRCULAR.

LONDON, *June 3rd, 1884.*

Stock of Timber, Deals, &c., at the Public Docks on 1st June.

		1884.	1883.	1882.
East Indian Teak, ...	in loads,	8,300	2,100	2,500.

EAST INDIA TEAK.—There are several cargoes discharging to be added to the dock stock. The deliveries in the five months have been 4,537 loads against 4,414 loads last year; and for the month 964 loads against 698 loads last year. There is no change and no wholesale business to report. The retail demand continues at a steady rate, but prices are lower than last month.

MAHOGANY.—Supplies continue to arrive freely; but cargoes are mostly brought to auction as soon as they are ready for sale, and therefore Importers' stocks are kept down. For really good logs of medium and large dimensions there is an unabated demand at fully sustained prices, but small, poor logs continue to be so heavily imported that for this description prices have further yielded.

EBONY.—*Ceylon* and *Bombay*.—Large, sound, well-grown logs would sell readily and well.

Price Current of wood.

Indian Teak, ...	per load,	£ 14	to	£ 16
		Per foot superficial.		
Mahogany—		*d.*		*d.*
Honduras, ...	cargo average,	4½	to	6½
Mexican, ...	„	4½	to	5½
Tabasco, ...	„	4½	to	6½
Cuba, ...	„	5¾	to	7½
St. Domingo, ...	„	5¾	to	7½
„ Curls, ...	„	12	to	20
Satin wood—		*£ s.*		*£ s.*
East India, ...		6 0	to	8 0
Rosewood—				
East India, ...		5 0	to	7 0
Ebony—				
Ceylon, ...		9 0	to	14 0
Bombay, ...(nominal),		8 0	to	10 0
Cocus wood, Cuba,...		6 0	to	7 10
Boxwood, Turkey, ...		5 0	to	20 0
Lancewood Spars, each, fresh and large,		0 9	to	0 12
„ ordinary to fair, ...		0 4	to	0 7

IV. Notes, Queries and Extracts.

MEETING ABOUT THE GRAZING QUESTION AT DARJEELING.

The Gwallahs of Darjeeling have circulated the following petition in the station, and the question of grazing rules was discussed in a meeting of the Eden Sanatarium on the 20th May last, Mr. Home contributing a memorandum, which we give below as an extract from the "Darjeeling News." We are glad to hear that the Gwallahs have abandoned their threats of leaving Sikhim, and that the Darjeeling people get their milk as usual, though their eyes have been opened to the possibility of their milk being somewhat watered, when we consider the small number of cows, and the fact that they are said barely to yield a seer of milk each per diem.

Petition of the Gwallahs of Darjeeling to the Residents.

The Gwallahs supplying milk to Darjeeling, represented by the undersigned, beg respectfully to call upon the residents to aid them in getting their grievances against the Forest Department redressed. Last year they petitioned the Government against the oppressive exactions and restrictions of the Forest Department, but without any good result, and if the residents do not now make some satisfactory arrangement with Government, it will be impossible for the Gwallahs then to remain in the district.

The following are some of the grievances that are most intolerable :—

1*st*.—The grazing ground is insufficient and bad. The portions of forest allowed them for grazing are very steep khuds. In consequence many cows get injured or killed.

2*nd*.—The difficulty the cows have of supplying themselves with food makes the milk very much less in quantity, the majority of cows do not give even a seer of milk a day.

3*rd*.—Hence the calves (which have to be tied up that they may remain within the limits assigned) die in large numbers for want of nourishment.

4*th*.—The places where the cows are allowed to feed are scattered here and there, and this arrangement is vexatious, and the cause of disputes also obliges us to keep a large number of servants to prevent the cows straying.

5*th*.—We are not allowed to get leaves for the calves to feed on at night, this is absolutely necessary, yet the chaprasís come round, and if they find a few leaves we are invariably fined heavily from Rs. 5 to Rs. 15 for each offence. *Vide* Darjeeling Court Records.

The leaves we have taken for the calves at night are from trees that are never used save for fuel. This can be certified to by reference to the subordinate officers of the Forest Department.

6*th*.—The tax upon each cow has been for the last six or seven years 8 annas per month. Eight years previous to this it was 4 annas a cow, and before that 2 annas.

7*th*.—What we ask is that on the Ghoom spur we may have assigned a larger amount of grazing ground in one place, say on both sides of the road between Lepcha Jagat and Jore Pokri. On Senchal spur we ask for the portion up to Reshap and Sureil.

8*th*.—We have been always loyal subjects and law-abiding of the British Raj. In the war with Sikhim we did specially good service;—when there were few others that helped them, no Nipalees or Lepchas, we stood by them: nothing on the score of acts against law can be brought against us. We have been peaceful subjects and useful to the residents.

It is only the *zulm* of the Forest Department that has at last compelled us to the present measure. We have no wish to leave the district, but we cannot endure the present state of things.

9*th*.—In conclusion, the Gwallahs now represent to the Residents of Darjeeling the difficulties the Forest Department put in their way. The Gwallahs last year made a representation to Government; but without any good result, and they now ask that the Residents send themselves the matter to Government, asking Government to communicate to the Gwallahs what help they intend to give.

In case the Gwallahs get no assistance they will reluctantly be driven from the district for no cause but that of oppression, and they shall be very sorry to cause inconvenience to those gentlemen and ladies who have so long been customers, but it is no fault of the Gwallahs.

RENCHIDEN BHOOTEA.
KHEOKA BHOOTEA.
ANJOO BHOOTEA.
TASI GOLLA BHOOTEA.
JOORME BHOOTEA.
SIRPENJO BHOOTEA.
and others.

DARJEELING,
The 12th May, 1884.

MR. HOME'S *Memorandum on Grazing of Cattle for the supply of milk and butter to Darjeeling, and of draught cattle.*

The area of forests under the Forest Department included in the Darjeeling Forest Division is 64,842 acres. This includes 41,254 acres (the Singalila Range) on the further side of the Little Rangit, the whole of which range, with the exception of the Little Rangit block (2,087 acres), is open to grazing, which is also permitted in 11,397 out of the remaining forest area,

23,588 acres, so that out of a total area of 64,842 acres, 14,278 acres only are closed against grazing. Omitting the area on the further side of the Little Rangit, there are 11,397 acres on which grazing is permitted ; the last returns (April 1884) show that 334* cattle (including draught cattle) pay for grazing on this area, which gives over 33 acres of pasture land to each head of cattle.

From the above figures it will be seen that half the area of the forests under the Forest Department within a reasonable distance of Darjeeling, and on which the Department has to rely to meet the requirements of public works, the general public, and residents of the station in timber and fuel (which requirements are undoubtedly on the increase) is, under Government orders, left open for the grazing of cattle for the supply of milk and butter to the station, and of draught cattle.

In the memorandum on the management of the forests in the Darjeeling Division, April 1882, Dr. Schlich, the Inspector-General of Forests to the Government of India, went thoroughly into the grazing question.

He allows for 310 head of milk cattle for the Darjeeling supply, besides 120 draught cattle, and set aside the following blocks of forest for their grazing :—

Approximate distance to centre of block from Observatory Hill, Darjeeling, in miles, omitting fractions under half a mile.		Forest block.	Area, in acres.	Number of cattle paid for grazing in April 1884.
In a bee line.	By road.			
		For Darjeeling Supply.		
3½	5	Senchal, ...	517	26
4	7½	Tiger Hill, ...	755	18
3½	8	Rangjo, ...	1,100	29
6	9½	Balasan, ...	811	24
		Carried over, ..	3,183	97

* This figure 334 was supplied to me when drafting this portion of my note on the 11th May. On going into details in the table given above, I find the actual number of cattle to be 234 in April, and that it was 272 in March. The average area for cattle in April was therefore over 48 acres per head.

Approximate distance to centre of block from Observatory Hill, Darjeeling, in miles, omitting fractions under half a mile.		Forest block.	Area, in acres.	Number of cattle paid for grazing in April 1884.
In a bee line.	By road.			
		Brought forward, ..	3,183	97
		For Darjeeling Supply.		
6	9½	Chongtong, ...	1,047	16
8	14	Parmaigiri, ...	1,284	4
7	14	Palangdong, ...	931	7
8½	15	Pagrainbong (part), ...	400	19
6	14	Tukdah, ...	668	12
		Total, ..	7,513	
		For Kurseong Supply.		
5½	7½	Pachim, ...	468	..
7	9	Chattackpur, ...	875	43
		Total, ..	8,856	
		Subsequently opened at the request of the Deputy Commissioner under Government orders.		
4½	6½	Sonada, ...	665	..
5	10½	Rangbi, ...	1,037	4
3½	6½	Nai, ...	839	32
		Total, ..	2,541	234
Average distance 5½	9½	Grand Total, acres, ..	11,397	..

The Pachim and Chattackpur blocks, though opened for the Kurseong supply, are really used for the Darjeeling supply.

The actual number of cattle paying for grazing last month on this area was 334, and Government ordered these last three blocks to be opened, as it was considered that Dr. Schlich's estimate of the number of cattle to be grazed was under the mark. The result however shows that Dr. Schlich over-estimated the number of cattle to be provided for.

With reference to the specified complaints of the Gwallahs :—

1*st.*—Last rains they complained of one block only, the Nai block, being too steep for grazing.

This block was recently visited by the Deputy Commissioner (Mr. Wace) under the orders of Government, and it was decided (Tenduk, Tehsildar, concurring) that with the exception of about one-fourth of its area (or 210 acres), there was no just ground for the complaint.

2*nd.*—The area open for grazing within reasonable distance of the station is over 33 acres per head of cattle, which must be admitted to be ample provision for the purpose.

3*rd.*—The calves are stall-fed, or graze with the cattle at the option of the graziers, who are allowed to cut grass and bamboo leaves for them free of charge. It is only when the branches of trees and saplings are cut for this purpose that the Forest Department raise any objection.

4*th.*—The blocks open to grazing are contiguous in the following groups :—

Senchal, ...		
Tiger Hill, ...		Acres.
Rangjo, ...		
Rangbi, ...		5,417
Sonada, ...		
Pachim, ...		
Chattackpur, ...		
Balasun, ...		
Chongtong, ...		
Parmaigiri, ...		4,473
Palangdong, ...		
Pagrainbong, ...		
Nai, ...		839
Tukdah, ...		668
Total acres, ...		11,397

5*th.*—The fines referred to are judicial fines, and with the very small staff we have, it may be safely assumed that for one offence in which the offender is caught red-handed (we cannot prosecute in any other case), fifty are committed of which we know nothing except the results to the trees in the forests.

The damage done by lopping is so serious, that special rules for stopping it have for some time been under consideration.

6*th.*—The question of grazing blocks, &c., was fully gone into in 1882-83, and in February 1883, *all* graziers came up to the Forest office to settle in what blocks they were to graze, in accordance with the proposal of the Deputy Commissioner. No question was *then* raised as to rates, nor have the rates ever been objected to. The complaint is obviously altogether frivolous, as this is the first time they have said anything about it in seven years, and the remedy is in the Gwallahs own hands.

7th.—*See Map.*—The area open on the Ghoom spur in one continuous block is 4,473 acres. They have the *whole* of the land on both sides of the ridge from Lepcha Jagat to Jore Pokri, with the exception of a strip of about half a mile on the north side of the ridge at Lepcha Jagat.

On Senchal spur they have a continuous block of 5,417 acres; they have the whole of the portion up to Suriel and Rishap, including those blocks, with the exception of the Rungbul block (650 acres).

Whoever the writer of the petition may be, he evidently does not know anything about the country, and did not take the trouble to study the map. If the Gwallahs had written the petition themselves, it is impossible that they could have made the mistake of asking for what they have already got.

8th.—One complaint only has come to my notice since I took charge in December 1882, which the Forest officer made over to the Deputy Commissioner for disposal.

I find no record of a complaint of any sort against the subordinates of the Department before I took charge.

9th.—If by "help" the Gwallahs mean that they require a larger area for grazing, the Forest Department cannot assist the residents in getting over the strike with which they are now threatened.

The Department has already, under Government orders, opened a considerably larger area than was deemed safe by their Inspector-General, and if the Gwallahs consider the 33 acres per head of cattle that are now open for grazing to have become too poor for that purpose, this result can only have been attained by their own actions, and no doubt chiefly owing to their wanton practice of lopping, and thus depriving the soil and young growth of their natural protection.

As to the suggestion that the blocks of forests soon to be cut over for the supply of timber and fuel to the station, and regenerated could without damage be opened to graziers, the absolute necessity for keeping such blocks closed to grazing for a number of years before they are worked has long been recognized. Were cattle admitted, the whole of the young growth, on which the regeneration has chiefly to depend, would disappear, and the cost of re-stocking the area would be very greatly increased.

General Remarks.—The Forest Department have given up more than half of the available area of forest within a reasonable distance of the station already.

The area per head of cattle is very large indeed (33 acres), notwithstanding which the graziers complain that the land open to them is too poor to support their cattle. The area under the Department is deemed barely sufficient to meet the demand there is on it for timber and fuel. The portion that has already been grazed over is practically cleared of young growth by the

grazing, and the older growth is gradually being killed out by the lopping. The absence of young growth is not in itself an insurmountable obstacle to regeneration, if the areas opened to grazing are judiciously selected, but the lopping does not only very seriously retard the regeneration of any given area; it makes the subsequent re-stocking of the forest a very slow and expensive operation, and greatly diminishes the outturn of the old stock.

If the supply of timber and fuel to the station and Public Works from the area under this Department is to be sufficient and continuous, there is no doubt that this practice of lopping must be put a stop to altogether. The Department has tried to stop it for the last 15 years by warning and occasional prosecutions under the law in force. The evil has become so great, that it is feared unless special measures are adopted in the form of severe rules passed under the Forest Act, the forests under this Department might eventually be reduced to a state similar to that in which the municipal land near Ghoom now is.

My attention was drawn to this soon after I took over charge of the Department, and the matter was brought to the notice of the Deputy Commissioner towards the close of last year.

The following draft rules under section 75 (d) of the Forest Act are now under consideration before submission to Government, which though some may consider severe, are not deemed by the Department to be more so than the exceptional circumstances of the case require.

"Every grazier occupying a *bathán* or grazing camp within the boundaries of the reserved forests of the Darjeeling Division, will become liable to fine and payment of compensation, as defined in section 25 of the Forest Act, for every tree or sapling that may be lopped or in any way damaged by a cutting instrument, within a radius of 800 feet from the site of his *bathán*, unless he shall have made a report to the nearest Forest officer or Forest guard within three days of the occurrence of such damage, and afforded reasonable assistance towards the apprehension and conviction of the offender."

A similar rule is in force in all State and Communal forests in France, and is given in Article 45, Code Forestier.

If it is considered inadvisable to pass a rule that bears only on a particular class of persons who frequent the reserves, the following rule has been suggested as a substitute.

"Whoever is found in a reserved forest in the Darjeeling Division off the ordinary roads and paths having in his possession bill-hook, axe, saw, or other cutting instrument of like nature, without a license according him permission to carry such instrument, shall be punished with a fine of from one to ten Rupees for each offence, and with confiscation of the said instrument or instruments."

A similar rule is in force in all State and Communal forests in France, see Article 146, Code Forestier.

DARJEELING,
The 18th May, 1884.

P.S.—As there was an error in my note as regards the number of cattle grazed, I give below the actual number that paid for grazing for the last three years :—

			Average for month.
1881-82,	...	4,198	... 350
1882-83,	...	4,972	... 414
1883-84,	...	3,765	... 314

The falling off in last year is due to the cart traffic having grown less since the reduction of rate on the railway.

The cattle that grazed in 1883-84 were distributed among the blocks open for grazing as follows :—

Forest block.	Cows.	Buffaloes.	Bullocks.
Senchal, ...	137	0	24
Tiger Hill, ...	98	0	0
Rangjo, ...	558	0	0
Balasan, ...	283	0	0
Chongtong, ...	220	0	0
Parmaigiri, ...	200	63	0
Palangdong, ...	476	51	0
Pagrambong (part), ...	78	158	0
Tukdah, ...	262	0	0
Pachim, ...	35	0	0
Chattackpur, ...	36	21	449
Sonada, ...	0	0	152
Ranghi, ...	118	0	0
Nai, ...	310	0	36
Total, ...	2,811	293	661
Average per month, ...	234	25	55

21st May, 1884.

GOATS, FORESTS AND FAMINES.—The remark that great events often arise from very insignificant causes, though far from original, is nevertheless true. The statement holds good in the moral, physical, and political world, and numerous instances might be given in each case. The white-ant is able to undermine large

buildings and destroy valuable property; a little insect, it is said, raises the large coral reefs in the South Sea, those terrors of the mariner and cause of so much loss. In the same way, it is believed that the goat has a good deal to do with the terrible famines that now and again visit this land. The connection may not at first sight be apparent; in fact, cause and effect may not seem plainer than the Goodwin sands and the church which stands close, and which always go together in the minds of sailors. But if we look a little further, we shall find that to those little animals may be set down the loss of life of thousands, perhaps millions, of people. The explanation is this. The goats destroy the young trees, and thus lay the land bare, when famine follows. Many of the forests that have not been cut down are simply used as grazing ground for cattle, sheep, and goats, and though the two former do much harm, the loss caused by them is small as compared with that brought about by goats. There is another way in which these creatures cause much harm. In spite of the daily and largely increasing demand for fuel, during the past twenty-five years more specially, the jungles and forests bordering the water-courses would not have undergone such utter extinction as they actually have, had it not been for the ravages committed by sheep and goats. The subject has never been brought into prominence until very recent years; but now when the labours of naturalists and physical geographers have shown how nice and exact is the balance through all nature between the *fauna* and *flora* of a country, and how disastrous the effect upon the one may be from a disproportionate activity of the other, there is no further excuse for shutting our eyes to the necessity of remedying the grave evil which has already been occasioned on this head in different parts of India. If we take the Madras Presidency we shall find that there are probably more than fourteen millions of goats, a number so manifestly in excess of what the present scanty pasturage can support, that the reason is plain why the young forest trees of the country have no chance of existence, and why the water-courses upon whose banks their stunted skeletons grow are merely dry ravines, filled up with stones and sand. We are told by a traveller how the introduction of goats into St. Helena utterly destroyed a whole *flora* of forest trees and with them all the insects, *molusca*, and perhaps birds directly or indirectly dependent upon them. And though of course the limited area of that island, and the unlimited powers of reproduction inherent in goats, made the catastrophe which supervened in St. Helena more evident and decisive, there cannot be the slightest doubt that the very same process of destruction is going on over the whole of India.

It has been stated—and we see no reason to doubt the statement—that the barrenness of Central Asia is due, in a great measure, to the destructiveness of the flocks and herds of the nomadic tribes. A traveller visiting this part of the world says :—

"It was in the Kizzilkoom desert that I first appreciated the enormous force of these scourges. Once, as evening fell, I met a flock of goats advancing across the wilderness in a compact mass, one of whose points was occupied by the leading animal. The dimensions of this moving mass I judged to be about 150 yards long by 100 broad, and its area would, therefore, have been 7,500 square yards, and allowing two animals per square yard, there were 15,000 goats in the flock! During the whole of the day these animals had been scouring the adjacent country for miles in search of food, and every young shoot of vegetation they found must have been destroyed! Under such circumstances, is it any wonder that no water is to be met with, and that nature presents such unchangeable and persistently repellent aspects for mankind in regions where the youth of our race was passed?"

To a certain degree the same animals are rendering parts of India unfertile, by destroying the trees and stopping the water-courses, thus changing the character of the rainfall, thereby bringing about famine, and causing loss of revenue and loss of life. It has now been pretty well settled that rainfall and forests are intimately connected; that where the latter are destroyed, the former becomes irregular, and in certain cases ceases altogether. There are points about the subject that it may be difficult to explain; but the mind that cannot connect the different links in the chain between forests and rainfall must be remarkably constituted. Marsh settled the question years ago, and his work is unanswered and unanswerable. Before the destruction of the forests in Mysore the rainfall was regular, while, although we may have an average during the year, it may come down at any time. Last year we narrowly escaped a famine. If the rain had not fallen when it did, there would have been a repetition of 1876, and the loss to the province would have been something terrible. The lesson to be learned is obvious. The conservation of the remaining forests ought to have more attention paid to it, and for every tree cut down another ought to be planted. The whole subject has been neglected too long, and Government should take the matter up as one of vital importance. It is hard to say what ought to be done with regard to the destructive qualities of the goats, but the subject is well worthy the attention of a Government that professes to have the welfare of the people at heart.—*Bangalore Examiner.*

ARTIFICIAL INDIA-RUBBER.—India-rubber and gutta-percha have become of such universal use, especially for telegraphic and surgical purposes, and so much concern has been from time to time expressed that the artificial production of these products would interfere with the regular growing of this plant in India, Ceylon, and other countries, where the rubber tree is

indigenous, that a brief mention of the various chemicals more or less suitable for its production may be of interest. Sulphur of course stands pre-eminent, fulfilling as it does many of the requirements necessary for a substitute. It is unattacked by acids, alkalies or salts, and when melted its great brittleness gives place to a softness, pliability and even elasticity, if properly treated by being poured into cold water while in a liquid state. To obtain this elasticity however it must be dissolved twice (at different temperatures), as it is only after its second melting that it possesses to any extent the elasticity of rubber. Alumina soap has been much experimented with. Its tenacity is undoubted, and it undergoes many curious changes when melted with resin and thick linseed varnish. A German scientist has I hear even patented a composition of sulphur, copal, oil of turpentine and albumen—with what success is not yet known.

A substitute for India-rubber must, however, fulfil two most important conditions. It must be *cheaper* and it must retain its elasticity *permanently*. In view of the high prices commanded by India-rubber, many materials can be found which will fulfil the first requirement—that of comparative cheapness. But it is in the latter important particular that all artificial substitutes have so far failed. Sulphur, if properly proportioned in its melted state with linseed oil varnish, can be rendered permanently soft, but this is of course a very different condition to elasticity. The only direction in which chemists are likely to be at all successful in producing a real substitute for rubber is by looking for some permanently elastic substance which will destroy the crystalline structure that makes sulphur so brittle, and render it impossible for it to return to its former condition ; and it is in this direction only I think that comparative success may be looked for. It will however always be difficult to imitate this elasticity, and the substitutes for India-rubber will meanwhile only find use where this elastic property does not come into prominence.—R. K. J.—*Indian Agriculturist.*

V. Extracts from Official Gazettes.

1.—Gazette of India—

No. 402.—*The 12th June, 1884.*—*Mr. H. H. Davis*, Deputy Conservator of Forests of the 2nd grade in Bengal, is appointed to officiate in the 1st grade of Deputy Conservators during the absence of *Mr. G. W. Strettell*, on three months' furlough on medical certificate, or until further orders.

No. 410.—*The 18th June, 1884.*—The undermentioned Officiating Assistant Conservators of Forests of the 3rd grade in the provinces noted opposite their names are confirmed in their appointments, with effect from the 14th May, 1884:—

Mr. J. C. Murray, British Burma.

Mr. B. A. Rebsch, North-Western Provinces and Oudh.

Mr. H. G. Young, Assam.

No. 466.—*The 27th June, 1884.*—The following temporary promotions are made among Conservators of Forests during the absence on three months' privilege leave of *Mr. G. Mann*, Officiating Conservator of Forests of the 2nd grade in Assam, or until further orders:—

Mr. A. L. Home, Conservator of Forests of the 3rd grade in Bengal, to officiate in the 2nd grade of Conservators of Forests.

Mr. J. T. Jellicoe, Officiating Deputy Conservator of Forests of the 2nd grade in Assam, to officiate in the 3rd grade of Conservators of Forests, and to have charge of the Forest Department in Assam.

2.—Calcutta Gazette—

The 30th May, 1884.—*Mr. C. A. G. Lillingston*, Assistant Conservator of Forests of the 2nd grade, is appointed to officiate in the 4th grade of Deputy Conservators of Forests with effect from the 7th April.

Mr. E. E. Wylly, has passed in Oorya by the Lower Standard, and *Mr. R. L. Heinig*, in Hindustani by the Higher Standard.

The 11th June, 1884.—*Mr. G. A. Richardson*, Deputy Conservator of Forests, is promoted to officiate in the 2nd grade of Deputy Conservators, with effect from the date on which *Mr. G. W. Strettell*, Deputy Conservator of the 1st grade, availed himself of the three months' furlough granted to him under orders dated the 13th May, 1884.

The 21st June, 1884.—In the notification dated the 30th May, 1884, published in the *Calcutta Gazette* of the 11th June, 1884, regarding the promotion of *Mr. C. A. G. Lillingston*,

Assistant Conservator of Forests of the 2nd grade, to the 4th grade of Deputy Conservators, *for* the words "with effect from the 7th April," *read* "with effect from 7th May."

3.—North-West Provinces Gazette—

No. 410.—*The 18th June, 1884.*—The undermentioned Officiating Assistant Conservators of Forests of the 3rd grade in the provinces noted opposite their names are confirmed in their appointments, with effect from the 14th May, 1884.

* * * * *

Mr. B. A. Rebsch, North-Western Provinces and Oudh.

* * * * *

4.—Punjab Gazette—

No. 302.—*The 20th June, 1884.*—With the approval of the Government of India, the Hon'ble the Lieutenant-Governor is pleased to appoint Ranger Ladha Singh an Officiating Probationer in the class of Sub-Assistant Conservators of Forests with effect from the 4th November, 1883.

No. 305.—*The 21st June, 1884.*—With reference to Notification No. 163, dated 28th March last, *Mr. E. McA. Moir*, Assistant to the Superintendent of the Simla Hill States, is invested with the powers of a Magistrate of the 2nd Class as defined in Section 32 (*b*), of the Code of Criminal Procedure, 1882.

5.—Central Provinces Gazette—

No. 2727.—*The 7th June, 1884.*—With reference to Notification No. 1856 of 27th May, 1882, *Mr. F. C. Hicks*, Assistant Conservator of Forests, on return from furlough is temporarily attached to the Direction Division.

Mr. Hicks reported his arrival at Nagpur and assumed charge of his duties on the afternoon of the 31st ultimo.

No. 2728.—*Mr. F. C. Hicks*, Assistant Conservator of Forests, attached to the Direction Division, is posted to the Chhindwara District.

No. 3017.—*The 24th June, 1884.*—*Mr. G. F. Taylor*, Assistant Conservator of Forests, in charge of the Nagpur Forest Division, is, as a temporary measure, attached to the Direction Division, with effect from the 1st current, in addition to his other duties.

No. 3103.—*The 27th June, 1884.*—Three months' privilege leave is granted to *Mr. W. Jacob*, Deputy Conservator of Forests, Seoni Division, from the 12th proximo, or the subsequent date on which he may avail himself of it.

Muhammad Ghouse, Sub-Assistant Conservator of Forests, is appointed to the charge of the Seoni Division, during *Mr. Jacob's* absence on leave, or until further orders.

6.—British Burmah Gazette—

No. 15.—*The 3rd June, 1884.*—Under the provisions of section 74 of the Civil Leave Code, privilege leave for 17 days—

from the 20th May, to the 5th June, inclusive—is granted to *Mr. C. W. Palmer*, Deputy Conservator of Forests.

No. 16.—*The 5th June, 1884.*—Under the provisions of section 74 of the Civil Leave Code, privilege leave for one month is granted to *Mr. E. P. Popert*, Deputy Conservator of Forests, with effect from the 15th June, next, or the subsequent date on which he may avail himself of it.

No. 17.—*Mr. H. Slade*, Assistant Conservator of Forests, is appointed to the charge of the Toungoo Division as a temporary measure during the absence of *Mr. E. P. Popert*, Deputy Conservator, on privilege leave, or until further orders.

No. 18.—Under the provisions of section 74 of the Civil Leave Code, privilege leave for three months is granted to *Mr. J. W. Oliver*, Deputy Conservator of Forests, with effect from the 17th June, 1884.

No. 19.—Under the provisions of section 50, Chapter V, of the Civil Leave Code, *Mr. J. Nisbet*, Deputy Conservator of Forests, is granted two years furlough to Europe, with effect from the date on which he may avail himself of it.

No. 20.—*The 12th June, 1884.*—Under the provisions of section 74 of the Civil Leave Code, privilege leave for three months is granted to *Mr. J. Nisbet*, Deputy Conservator of Forests, with effect from the date on which he may be relieved by *Captain C. T. Bingham.*

This Department notification No. 19, dated the 5th June, 1884, granting two years' furlough to *Mr. Nisbet*, is hereby cancelled.

7.—ASSAM GAZETTE—

Rights of Government to Forest Produce.

Circular No. 19, dated Shillong, the 25th April, 1884.

From—E. STACK, Esq., C.S., Offg. Secretary to the Chief Commissioner of Assam.

To—Deputy Commissioners of the Assam Valley Districts.

In forwarding a copy of notification No. 11, dated the 25th April, 1884, I am desired to point out that the reason for cancelling the notification dated the 31st December, 1883, is that the Chief Commissioner does not desire to assert the rights of Government to forest produce, other than reserved trees, standing on lands which have already been settled on annual, decennial, or *nisf-khiraj* leases. Provided that no royalty will be charged on trees which were paid for when the lease was given, or which have grown since the lease was given, and that on *nisf-khiraj* lands royalty will be charged at half rates only.

2. In future, whenever an application is made for a lease of waste land, all forest produce on that land will be valued by a Forest Officer on the principles laid down in Circular No. 27, dated the 15th October, 1878, and Circular

No. 50, dated the 25th September, 1879. These principles, with some modifications, are now re-stated.

3. Before a lease is given for any waste land (whether it be annual or decennial, or a waste land grant for 30 years), reference must be made to the Forest Officer, who will value the forest produce on the land. This supersedes paragraph 10 of Circular No. 24, dated the 13th April, 1876, under which the valuation on waste-land grants was to be made by the Deputy Commissioner. In framing his valuation, the Forest Officer will be guided by the following rules:—

(1). If there are but a few scattered trees, each tree should be valued separately. For trees of 4 feet and more in girth measured 4 feet from the ground, the full royalty as sanctioned by the Chief Commissioner for the time being must be charged: for trees of 2 feet and more, and less than 4 feet in girth measured 4 feet from the ground, half royalty only will be charged; and for trees of less than 2 feet in girth measured 4 feet from the ground, no charge at all will be made.

(2). If the trees are numerous, and the land is of the nature of forest land, the valuation should be made at an acreage rate according to the following classification:—

First-class forest,	...	from Rs. 12 to 20	per acre.
Second „	...	„ 4 to 10	„
Third „	...	„ 1 to 3	„

due regard being had to the size and quality of the timber, its accessibility, and any other conditions affecting its value on the spot.

(3). Land upon which sál timber is growing must not be assigned in any case without a reference having first been made to the Conservator.

If the Deputy Commissioner does not approve the valuation of the Forest Officer, reference shall be made to the Conservator of Forests.

4. The applicant must pay the value fixed on the forest produce before he receives the lease or enters on the land. Provided that—

(*a*). In case any time is likely to elapse before the Forest Officer can frame his valuation, the lease may be given at once on condition that the applicant declare his willingness to pay the value which may be set on the forest produce.

(*b*). If the applicant is a ryot taking the land on annual lease, the value of the forest produce need not be paid unless it is removed for sale.

5. Free grants of forest produce require the specific sanction of the Chief Commissioner in each case.

Revenue Department Notification No. 11, dated the 25th April, 1884.

In supersession of Notification No. 50, dated the 31st December, 1883, published at page 3 of the *Assam Gazette* of the 5th

January, 1884, which is hereby cancelled, the Chief Commissioner is pleased to prescribe the following rates of royalty to be paid in the Assam Valley districts on trees and other forest produce which are the property of Government, or were produced on Government land :—

		Rs	A.	P.
(1).	For every sál tree, ...	10	0	0
(2).	„ „ other reserved tree, ...	6	0	0
(3).	„ „ unreserved tree, ...	2	0	0
(4).	„ „ each pole or sapling, ...	0	1	0
(5).	„ „ boat or dug-out, the royalty payable on the tree out of which it is cut.			
(6).	For 100 *jangali* or *kata* bamboos, ...	1	0	0
(7).	„ „ *jati* bamboos, ...	2	0	0
(8).	„ „ *bhaluka* bamboos, ...	3	0	0
(9).	„ every 100 bundles of cane of 10 pieces each,	0	12	0
(10).	For every maund of charcoal, or for every nine cubic feet, if manufactured in the forests, ...	0	2	0
(11).	For every permit to remove firewood for one month, ...	1	0	0
(12).	Do. do. do. one year,	9	0	0

No. 187.—*The 29th May, 1884.—Mr. A. J. Mein*, Deputy Conservator of Forests, 3rd grade, made over charge of the Kámrúp Forest Division to *Babu Jogesvar Sur*, Forest Ranger, on the afternoon of the 19th March, 1884, and availed himself of preparatory leave on the same day. *Mr. Mein* reported his departure from Calcutta for Europe on furlough, on the 25th March, 1884.

No. 191.—Privilege leave of absence for three months, under Section 138, Chapter X. of the Civil Leave Code, is granted to *Mr. H. G. Young*, Officiating Assistant Conservator of Forests, Cachar, with effect from the 23rd June, 1884, or the subsequent date on which he may avail himself of it.

No. 194.—*Babu Jogesvar Sur*, Forest Ranger, is promoted to officiate as Sub-Assistant Conservator of Forests, with effect from the 20th March, 1884.

No. 199.—Privilege leave of absence for three months, under Section 71, Chapter V. of the Civil Leave Code, is granted to *Mr. G. Mann*, Conservator of Forests, Assam, with effect from the 22nd June, 1884.

No. 226.—*The 24th June, 1884.—Mr. James T. Jellicoe*, Deputy Conservator of Forests, made over charge of the Goálpára division to *Babu Ram Gopal Khan*, Extra-Assistant Commissioner, on the forenoon of the 11th June, 1884, and took over charge of the Kámrúp Division from *Babu Jogesvar Sur*, Officiating Sub-Assistant Conservator, on the afternoon of the 18th June, 1884.

8.—MYSORE GAZETTE—

No. 46.—*The 28th May, 1884.—Mr. J. Stephens*, Sub-Assistant Conservator of Forests, delivered over, and *Mr. Prahlada Rao*, Acting Sub-Assistant Conservator of Forests, received charge of the Sub-Assistant Conservator's office at Hassan on the forenoon of the 21st May, 1884.

9.—MADRAS GAZETTE—

No. 100.—*The 26th May, 1884.—Mr. R. W. Morgan*, Deputy Conservator of Forests, 4th grade, to act as Deputy Conservator, 3rd grade, *vice Mr. W. C. Hayne*, on furlough.

No. 101.—*Mr. G. Hadfield*, Assistant Conservator of Forests, 1st grade, to act as Deputy Conservator, 4th grade, *vice Mr. R. W. Morgan.*

P. T. Murugésa Mudaliyár, Forest Ranger, 5th grade (on probation), North Arcot Division, is granted one month's privilege leave (on medical certificate), under Section 138, Civil Leave Code, from the 16th May.

The 2nd June, 1884.—M. Shams-ud-din Sáhib, Forest Ranger, 5th grade (on probation), South Coimbatore Division, is granted one month's leave on medical certificate, under Section 128, Civil Leave Code, 6th Edition, from the 27th May.

The 6th June, 1884.—D. Thiravayam Pillai, Forester, Kangundi Estate, has passed the Survey Test prescribed by Standing Circular No. 2 of 1883-84 (G.O., Revenue Department, No. 1506, dated 1st December, 1883).

No. 226.—*The 11th June, 1884.—Mr. H. A. Sim*, District Forest Officer, Kurnool, privilege leave for three months, from or after the 16th instant, under Section 74 of the Civil Leave Code.

The 14th June, 1884.—Mr. P. M. Monteiro, Forest Ranger, 5th grade, (on probation), South Canara Division, is granted one month's privilege leave on medical certificate, under Section 138, Civil Leave Code, 6th Edition, in extension to that already granted by this office order No. 19 of 1884-85, of the 14th ultimo.

T. S. Sakárám Ráo, Forest Ranger, 4th grade, Madura Division, is granted three months' leave of absence on medical certificate, under Section 128 of the Civil Leave Code, 6th Edition, from the 16th instant.

C. Appáchi Pillai, Forester, 2nd grade, to act as Ranger, 4th grade, during the absence of *Sakárám Ráo*, or until further orders.

The 15th June, 1884.—Sheik Tippu Saib, Forest Ranger, Cuddapah Range, is granted extension of leave until the 25th August, 1884, in continuation of the leave without pay granted to him in office orders Nos. 1 and 7 of 1884-85.

No. 110.—*The 16th June, 1884.—Mr. G. Homfray*, Assistant Conservator, 3rd grade, to act as District Forest Officer, Kurnool, during the absence of *Mr. H. A. Sim*, Deputy Conservator, 1st grade, on leave, or until further orders—to join on relief by *Mr. A. W. B. Higgens.*

10.—BOMBAY GAZETTE—

No. 4787.—*The 13th June, 1884.—Mr. G. L. Gibson*, Divisional Forest Officer, West Khandesh, is allowed privilege leave of absence for two months and twenty-eight days from 10th July, 1884, or from such subsequent date as he may avail himself of it.

No. 4788.—*Mr. F. Gleadow*, Assistant Conservator of Forests, 3rd grade, is promoted to the 2nd grade, with effect from the 3rd October, 1883.

No. 4841.—*The 16th June, 1884.*—*Mr. R. S. F. Fagan*, Assistant Conservator of Forests, Ahmednagar, is allowed privilege leave of absence for three months from the 15th July, 1884, or from such subsequent date as he may avail himself of it.

No. 4845.—*Mr. J. S. Maidment*, Assistant Superintendent of Stamps, is allowed an extension for one month of the privilege leave for one month granted to him in Government Notification No. 4248, dated 27th May, 1884.

No. 4861.—*The 17th June, 1884.*—His Excellency the Governor in Council is pleased to make the following appointments in the Forest Department:—

Mr. S. Hornidge, A.M.I.C.E., to be 3rd grade Assistant Conservator of Forests.

Mr. Wáman Rámchandra Gaundé to be 3rd grade Sub-Assistant Conservator of Forests, vice *Mr. Hornidge*, promoted.

No. 5050.—His Excellency the Governor in Council is pleased to appoint *Mr. M. D'Cruz*, 1st grade Sub-Assistant Conservator of Forests, to act as Assistant Conservator of Forests in the Southern Circle from the date of *Mr. Hornidge's* confirmation in that grade and during the absence of *Mr. Mainwaring*, or till further orders.

No. 5136.—*Mr. R. C. Wroughton*, Deputy Conservator of Forests, 3rd grade, has been allowed by Her Majesty's Secretary of State for India an extension of furlough for two months.